November 1991 Issue #4

Radio Fun

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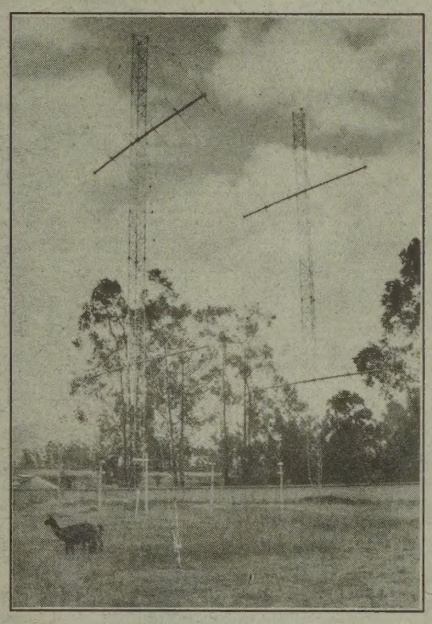
in this issue

Special Event Station Celebrates 60 Years of HCJB



Llamas graze beneath HCJB's 24-element cubical quad antenna at HCJB's international transmission site in Pifo.

If you'd like to add a rare QSL card to your collection, try QSOing (contacting) HCJB in Quito, Ecuador, this December. Ham operators will be on the air worldwide for 30 hours from 4 p.m. EST (2100 UTC) Friday, December 6 to 10 p.m. Saturday, December 7 (0300UTC Sunday, December 8). The special callsign for this event is expected to be HC6ØJB. Transmission will be on 14.225, 21.300, and 28.500 MHz (plus or minus a few kHz for receiving). To obtain your special QSL card, send a reception report to HCJB, Casilla 17-01-00691, Quito, Ecuador.

One of the most unusual aspects of this event is that HCJB hams will have access to some of the world's most powerful shortwave antennas, located at HCJB's international transmission site in nearby Pifo. Keith Clukey KC6SMW/HC1, an HCJB machinist and ham operator coordinating the event, explains, "We plan to have two hams working simultaneously on two different bands, depending on conditions. They will receive contacts in their homes in Quito and use the telephone to tap into HCJB's microwave system. The signal will then be beamed 18 miles to Pio for broadcast around the world via our Siemens SSB transmitter.

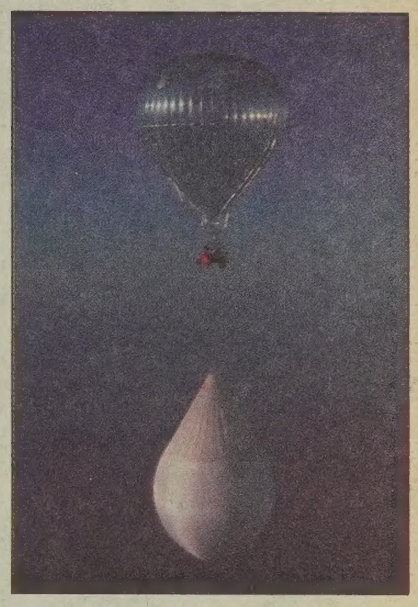
"The reason for this elaborate system is that we can't actually receive other stations in Pifo due to interference from all the transmissions there. We have 12 high-power transmitters operating at different times and frequencies.

"The Siemens transmitters, which first went on the air in the summer of 1990, are capable of putting out 30 kW, but they will be detuned to amateur limits (1.5 kW). However, our antennas will boost the signal strength considerably. The amount of gain will range from 18 to 25 dBi, depending on which frequency and antenna we're using at the time."

HCJB engineers have 31 antennas in Pifo. Antennas to be used for the special event range from a large rhombic to 30-story-high curtain antennas with eight parallel-fed dipoles. HCJB's unique steerable antenna, carrying 500 kW transmissions, will also be used.

But perhaps the most interesting antenna to be used in this event is the cubical quad. Station HCJB in Quito is famous in amateur radio as the birthplace of the cubical quad antenna. In 1945, Clarence C. Moore W9LXZ, an HCJB engineer, said that the vision of a quad-shaped antenna gradually grew from the idea of a pulled-

Continued on page 4

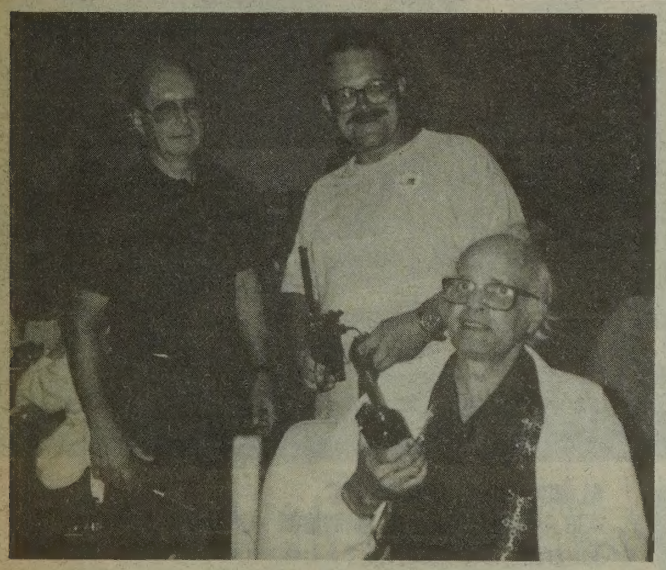


The Earthwinds non-stop round-the-world balloon flight.
Photo by Mark Greenberg/Visions.

Earthwinds Balloon

In mid-November, the Earthwinds around-the-world manned balloon flight will be launched from northeastern Ohio. Three balloonists will fly at 35,000 feet in a pressurized capsule as they circle the globe. Captain Larry Newman KB7JGM plans to operate from the balloon on 28.303 MHz throughout the mission. In addition, when he is occupied with other duties, there will be a CW or voice telemetry downlink on this frequency which will periodically relay the balloon's current latitude, longitude, altitude and ground speed. Since this is the same frequency that is used by the CQ All Schools Net (every Tuesday and Thursday 12:30–1:30 p.m. Eastern time), it's hoped that schools as well as hams worldwide can have a great time tracking the balloon's progress on its record-breaking non-stop flight.

While over the U.S., there will also be a live TV downlink from the capsule on 434 MHz (fast-scan ATV) as well as a 2m FM signal on 144.340 MHz. Those of you with cable-ready TVs or VCRs can receive the TV signal on cable channel 59 (NOT the same as UHF channel 59) as long as you use an outside antenna. The VHF and UHF coverage range will be about 250 miles either side of the flight path. The expected flight path will take the balloon from it's launch point in Ohio over Pennsylvania, New York state, New England and then on across the Atlantic to Europe. Approximately two weeks later the balloon will come back across the Pacific Northwest and the central states as it completes its round-the-world journey to land east of Ohio. The launch date will be the first day that the prevailing winds are good during mid-November. Check into your local packet BBS for updates on this flight. Also we will periodically post bulletins under the Special Events section of the *73* BBS at (603) 525–4438.



(Left to right) Ed Borow K2OQA, Joe Fairclough WB2JKJ, and George Adam WB1GAQ. Check out Joe's Classroom Net on 7.238 MHz at 1100–1230 UTC and 21.395 MHz at 1300–1900 UTC daily.

Unruly Guest

Bob, the first hurricane to hit New England since Gloria in 1985, forced at least 2500 people in the Boothbay Harbor area of Maine to seek shelter. Governor McKernan had called for the evacuation of a 150-mile stretch of coastline.

Thrown together by fate in the Boothbay Harbor Regional High School, which served as a shelter, were three amateur radio operators: well-known DXer Ed K2OQA, busy "Crew 22" leader Joe WB2JKJ, and world traveler George WB1GAQ. Being well-prepared hams, they came to the shelter with their handhelds and extra batteries. The three worked in shifts for a total of six hours, relaying information from the local 147.06 repeater to disaster workers at the high school and passing news on to fellow refugees.

International Callsigns

Great Britain. The Class B Novice license in Great Britain is codeless with limited frequencies allocated from 50 MHz up. Class B prefixes are followed by a "1." To obtain a Class A Novice license, the applicant must pass a 5 wpm Morse code test. Class A's are allowed some HF, as well as VHF, spectrum. Callsign prefixes are followed by a "0." Prefixes, as previously listed: England, 2E; Scotland, 2M; Wales, 2W; Isle of Man, 2D; Jersey, 2G; Guernsey, 2U; and Northern Ireland, 2I.

Germany. Amateurs from East Germany are in the process of having their callsigns changed to a DL prefix. This is the same prefix that West German hams use. The International Telecommunications Union (ITU) has asked East Germany to give up the Y2—Y9 callsign block next year for reallocation to another country. TNX *B-N-T Bulletin, Vol. 19, Issue 9* and *W5YI.*

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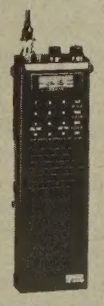
IC-W2A


IC-H16/U16


MOTOROLA RADIUS COMMERCIAL RADIOS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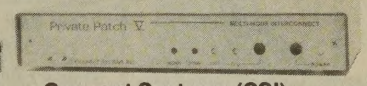

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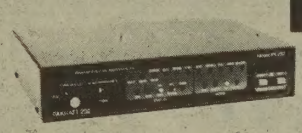

Panasonic
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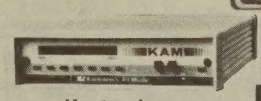

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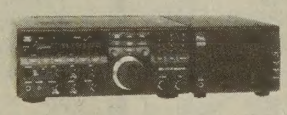

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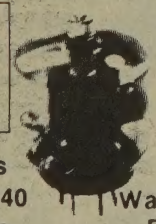

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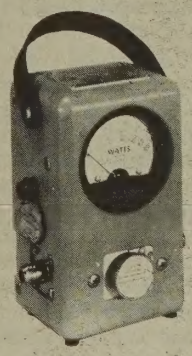

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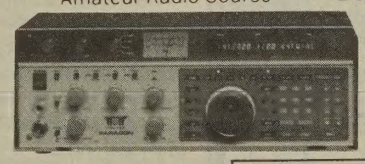

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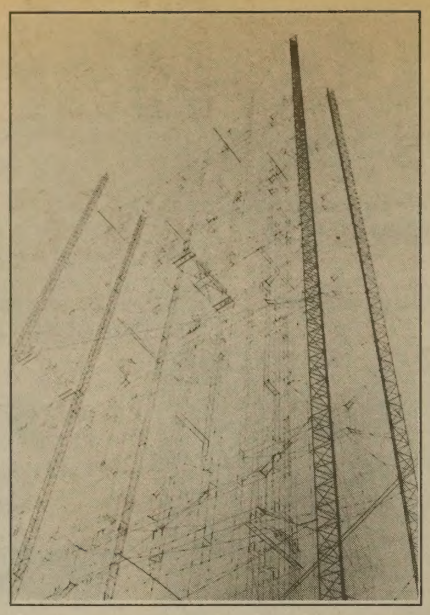

HCJB's bidirectional curtain antenna array for shortwave transmission to Europe and the South Pacific.

HCJB Celebrates 60th

Continued from page 1

open, folded dipole. He and other engineers were looking for a solution to antenna problems caused by operating in thin air at 10,000 feet in altitude. The 4-element, parasitic, high-Q beam antenna they had first installed was being destroyed by gigantic coronal discharges springing from the tips of the driven element and directors. Molten chuncks of aluminum were dropping to the ground as the antenna was slowly being consumed. The cubical quad, having no ends, proved corona-proof. (For more information, see *All About the Cubical Quad,* by William I. Orr W6SAI and Stuart D. Cowan W2LX.) HCJB's present quad antenna has 24 elements with four parallel-fed arrays, each six elements deep.

Clukey says, "Many ham radio operators first got interested in amateur radio by listening to distant shortwave radio stations such as HCJB." HCJB International Radio Director John Beck HC1QH says the events provide another opportunity to make personal contact with people interested in the station, and that numerous hams have written them asking how they can get in contact with ham operators at the station. More than 18 HCJB hams are expected to take part in the special event.

Although HCJB (Heralding Christ Jesus' Blessing) is a religious broadcaster with the primary purpose of spreading the gospel of Jesus Christ, many non-Christians are attracted to the station's varied transmission of news, cultural information, and general interest programs. HCJB, a ministry of the World Radio Missionary Fellowship, Inc., an evangelical, interdenominational organization, broadcasts in more than 18 languages and 22 dialects. It also operates two hospitals in Ecuador and helps serve the rural areas through community development and mobile medical clinics. And, finally, HCJB is involved in producing television programs and training Ecuadorians for leadership positions in medicine, radio, TV, evangelism, and music. The mission has offices in more than 20 countries, with local radio ministries in Texas, Panama, Ecuador, Argentina, and Europe. TNX Harold Goerzen of the World Radio Missionary Fellowship, Inc., in Opa Locka, Florida, for this information.

Reciprocity with Mexico

Mexican officials recently forwarded the instructions to the U.S. State Department by which U.S. citizens could apply for operating authority in Mexico. The expectation was that the reciprocity requirements would be similar to those the U.S. has with Canada—but they couldn't be more dissimilar!

Licensed Canadian and U.S. amateurs may operate in each other's country without needing to obtain permission or file paperwork. You simply append to your callsign the prefix of the other country. In contrast, according to the received instructions, to obtain a Mexican reciprocal amateur license, you must: 1. Complete and file an application form with the Secretary of Telecommunications in Mexico City 60 days before the planned operation. Besides the time period and location of your intended operation in Mexico, the application requires information on much personal data. 2. Agree to abide by Mexican amateur communications law. Fifty-five articles from the Mexican Amateur Radio Regulations are listed along with authorized amateur frequency bands for different classes and modes, and 12 articles from the Inter-American Telecommunications Conference that took place in Lima, Peru, in 1987. 3. Pay a fee of $181,000 pesos (about $60) to the National Bank of Mexico. This fee was in effect during the July-August-September trimester; the amount of payment may change for any future trimester. TNX *W5YI Report, Vol. 13, Issue #17.*

Spotlight on LUSAT-OSCAR-19

SpaceNews, John Magliacane KD2BD's newsletter received via e-mail and "the first amateur newsletter to be read in space," selected LUSAT-OSCAR-19 as their "satellite of the week" at the time of this writing. Each week they are featuring a specific satellite in response to numerous requests for amateur satellite transponder passband and beacon frequency information.

LUSAT-OSCAR-19, launched on January 22, 1990, has the NASA Catalog Number 20442. (If you don't know what that means, see the article "Bird Hunting" in this issue of *Radio Fun.*) Its orbit is low altitude, circular, sun synchronous, and almost polar.

The primary objective of this satellite is to provide the worldwide community of amateur operators with a satellite-based digital store-and-forward packet radio message system in low-earth orbit.

Uplink frequencies are, in megahertz (MHz): 145.840, 145.860, 145.880, and 145.900. (Uplinks are Manchester-encoded 3.5 kHz deviation FM.)

Downlink frequencies in MHz are: 437.153 (primary, raised cosine BPSK modulation); 437.125 (secondary, BPSK modulation); and 70cm CW beacon on 437.127 (12 wpm CW telemetry, 750 mW).

SpaceNews is often re-posted on local packet radio systems. KD2BD posts *SpaceNews* on Usenet, a Unix-based information system, and packet radio. The *73/Radio Fun* staff downloads *SpaceNews* from MCImail. TNX KD2BD.

In other space news from the *W5YI Report, Vol. 13, Issue #18,* the AMSAT-DL (Germany) advises that the European Space Agency has confirmed an October 1995 launch slot for the Phase 3D amateur satellite. The 10-foot-wide, 1200-pound doughnut-shaped bird will have an orbital period of exactly 16 hours to make it consecutively accessible over Europe, the U.S.A., and the Far East. Color imaging, educational broadcasting, and other experiments are planned. There are currently an even dozen OSCAR satellites in orbit! The latest, OSCAR-22, was launched on July 17 of this year.

The Next SAREX Mission

The next SAREX operation is tentatively scheduled for STS-45 on the *Atlantis*. Launch is currently set for mid-March 1992. This effort will use what's known as the "B" configuration. This means FM voice only with battery power only. This is an eight-day mission with a high inclination (57 degrees) at 160 nautical miles altitude. The average spacecraft orientation will be "OK" for the window-mounted antenna. Expect two-way voice QSO contacts (similar to the very first SAREX operation by W5LFL) from this flight. Currently there are two hams scheduled for this flight (both waiting for their Technician licenses), Dave Leestma and Brian Duffy.

Note also that Gil Carman WA5NOM keeps current Keplerian element sets (used for tracking programs) on the NASA JSC BBS at (713) 483–2500. Enter the number 62511 when prompted to reach the SAREX announcements.

TNX to Carl Kotila WD5JRD and Andy MacAllister WA5ZIB.

Youth Net Update

During the weekend of August 2–4, Sammy Garrett AAØCR, Darrel Craig KK6BB, and Mary Alestra KB2IGG operated special event stations to recognize the many young people in amateur radio, and to announce an HF net which began last September. Although there were some equipment difficulties, and band conditions weren't ideal, the special event was a huge success.

In his "Youthlink" column in *Westlink Report, No. 608,*, Sammy Garrett AAØCR says, "I would like to thank my parents for their great encouragement and help. Burt Hicks WB6MQV and Bill Pasternak WA6ITF were also there giving us some good advice and ideas that helped make it work. Credit is also due Yaesu USA for its support in many ways, especially its loan of an FT-990 transceiver. The receiver's digital filters made it possible to work several stations through the QRM .... Also, I'd like to recognize Darrel's professional operating style and perfection on the air ...."

Several hundred contacts were made, so QSL cards will be slow getting in the mail. If you worked any of the stations, remember to include a business size envelope with your QSL, and mail them to Sammy Garrett at P.O. Box 5832, St. Louis MO 63134.

Check in to the youth net On Sundays at 1830 UTC on 28.435 MHz, plus/minus QRM. AAØCR is Net Control, with several relay stations around the country.

Remember, too, that Carole Perry's CQ All Schools Net runs from mid-September through mid-June, and meets on 28.303 MHz at 1730 UTC Tuesdays and Thursdays. Try to check in!

Radio Fun

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issue #4

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letters

Linda Friars, Rothesay, N.B. Canada My son is 14 (soon 15, he says), and wants very much to learn about Hammers and CBing. He bought his 10 meter ham radio in a Radio Shack store in the States, and saved $200 as opposed to buying it in an RS store in our area. This confirms your young Cheap Ham this side of Canada.

Your suggestion about old Hammers going to schools and passing on their knowledge was also excellent. A course at night would be nice. I suppose in big cities this is possible, but in my area, the word is: If there are enough, we will have a course. So both of us have to wait and see, unless we can find someone willing to sit with us at night and teach the "rights and wrongs."

I am very new at this and haven't even turned the knob on my son's radio. He's new, too, and using his borrowed CB right now. Actually, we have a friend who hams via computer, so he will probably teach us. Meanwhile, we are waiting for the course.

James Graves N2LPO, Ontario NY I'm finally getting into amateur radio (35 years late). Getting both my son and daughter in health and welfare nets during Hugo peaked their interest, too. My first public service was two weeks after upgrading and receiving my 2m HT. A fellow naval reserve CPO talked me into helping Red Cross/RACES during our March ice storm. I am now hooked. I changed clubs to a more public service club (you helped that one), and I'm trying to get the club to do a special event for Scouting.

Please—more QRP, especially in the area of compact, efficient antennas (10–40m). I use a Yaesu FT-301S, and although contacts are not as frequent as with the 600 watt club station rig, I think they are more enjoyable. QRP accessories would be great (audio filters, SWR/PWR, antenna switches). Thank you for the "Square Pancake Antenna" article in the September issue of *73*, and thank WB8VGE for his "QRP" column.

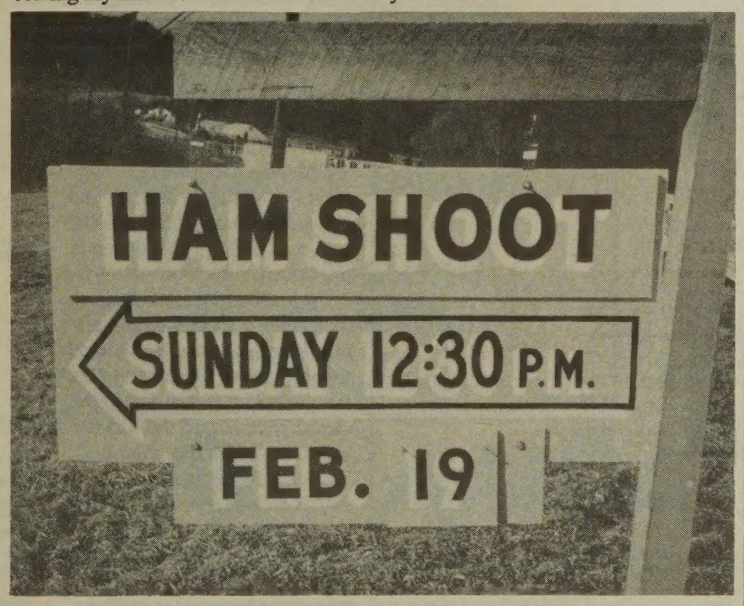
Mike Lasagne Please cease the stupid habit of encouraging amateur radio operators to construct indoor transmit antennas. The last ham who lived in this 100-unit apartment complex made life miserable for 25 people. At the time I moved in, this individual was putting RF into the wiring, the plumbing, TVs, VCRs, cordless phones, *everything*.

This individual thought he was putting something over on the people who live here. He wasn't. There are too many people in this area who had electronics training in the armed forces.

Needless to say, the amateur in question was booted out of this apartment complex, and the attitude of the 250 or so people who live here about amateur radio is not charitable.

Mike—A properly converted and operated indoor antenna shouldn't cause any more problems than an outdoor antenna. Unfortunately, it sounds like you had a bad experience with an inconsiderate ham. Your point about bad P.R. is well taken and is something we should all consider.
. . . David N1GPH

George F. Ledoux K1TKJ On a recent trip to Connecticut I found out how local residents have solved their TVI problems *[see the photo]*. Perhaps you would like to share this info with your readers.



According to K1TKJ, the residents in a Connecticut town have found a way to deal with hams causing interference problems.

Walter A. Smart N8PVT, Manistee MI 49660 I'm 42 and just passed the codeless Tech a few weeks ago. The VEs in Petosky, Michigan, were quite professional, supportive, and friendly. I felt great after passing. I was an avid SWLer between the ages of 10 and 15, until I discovered girls. Still, I figured I'd have my ham license long before now. But college, the war (Viet Nam), marriage, etc., all re-directed me to other endeavors. I doubt if I'd ever have gotten this far without the codeless option (I have my fingers in a dozen pies, had zero interest in ever operating code). As an SWL, I QSLed all states, did county hunting, DXed—all the things hams love except for transmitting.

As you can imagine, everyone has different advice (go packet, get your

Continued on page 24

what next?

by Carole Perry WB2MGP

What Next

Recently I had the pleasure of speaking with Pete Pedersen W7KTK from Payson, Arizona. He is the kind of enthusiastic ham we like to see getting involved with youngsters. Most hams can recall first getting interested in amateur radio because some ham took the time to explain, demonstrate, and share enthusiasm for the hobby.

A fertile environment for capturing the attention of youngsters is, of course, a school. Pete and the local radio club, the Tonto Amateur Radio Association, really did their homework when they prepared to bring amateur radio into an elementary school. The club is composed of many retired electronic types who felt that 12-year-olds needed to be exposed to the fun experiences that had appealed to *them* at that age.

Five years ago, the Tonto Amateur Radio Club conducted the "Great Crystal Set Contest." Their town is 100 miles from anywhere, and the new AM radio station was just being commissioned with low power output. About 12 children participated in the contest, and they were all declared "winners." This was done after school, with the club members acting as elmers.

An "elmer" is a licensed ham who helps and encourages others to get licensed, to select equipment and get on the air, and just tries to "be there" when needed.

Last year the elementary school principal invited the group to come back and conduct another radio construction project. The principal announced his intention of making this program a part of the 6th grade curriculum, in keeping with the state educational requirements. This amounted to a total 6th grade student body in two schools of 150 students. The principal had his teachers participating as well.

Pete and the club members began by putting on live ham radio demonstrations in the classrooms. Next, the names of electronic components and parts were added to the class' spelling lessons. Then "Q" signals were defined for the children to learn. The club also passed around exotic QSL cards for the youngsters to examine. Once they had all the kids' attention, they introduced the construction project.

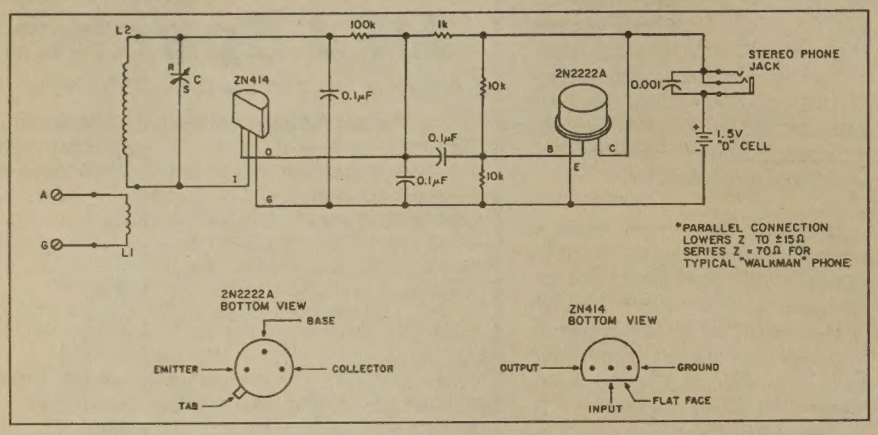


Figure 1. Schematic diagram of the receiver.

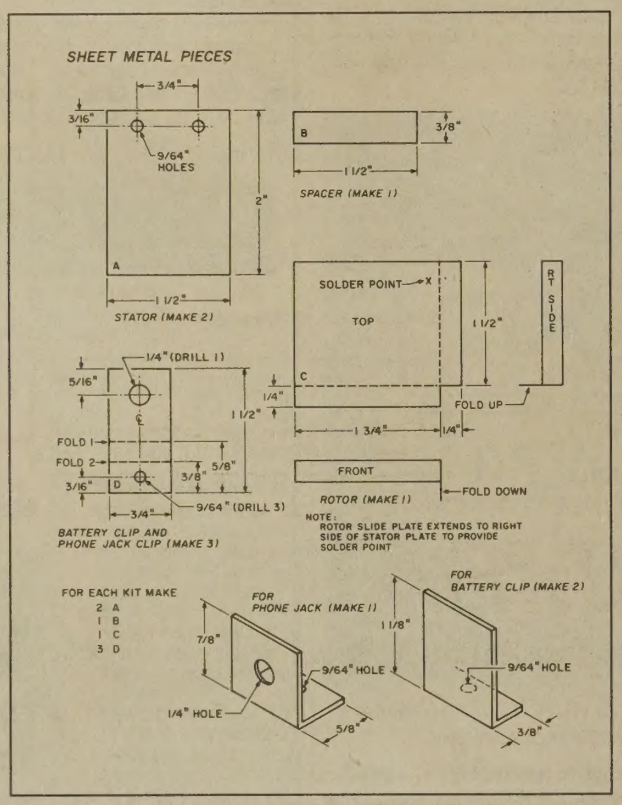


Figure 2. Dimensions of the sheet metal pieces.

Photo B. Coil winding with the wire tied to the fence.

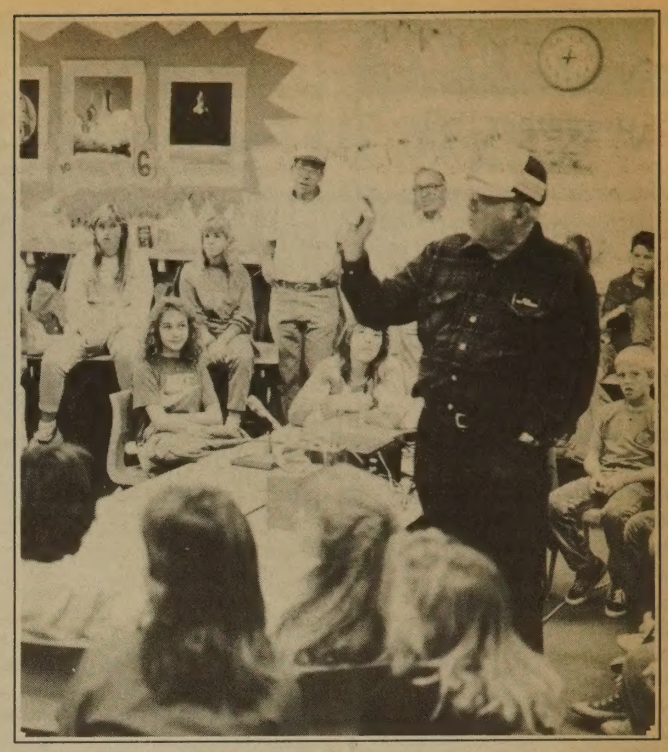


Photo A. W7KTK giving a lecture on ham radio. Other elmers, K7DRI (left rear) and KD7MO (right rear), stand by. Getting involved with youngsters is fun and fulfilling.

Build Your Own Radio Receiver

The construction project was developed around the Ferranti Integrated Circuit, the ZN-414. This ZN-414 is a "look-alike" to a TO92 transistor. It makes a complete T.R.F. (Tuned Radio Frequency) receiver with a 72 dB power gain and an integral detector. The three wires are named "I" (Input), "O" (Output), and "G" (Ground). What could be simpler?

The catch was that the students' headsets were Walkman-type with 18 ohm impedance. This was not too good a match for the HI-Z (high impedance) output from the ZN-414! So a second transistor, a 2N2222, followed the IC to convert the impedance from high to low. This would present a current signal output to drive the headphones (see Figure 1).

The stereo phones had to be parallel-connected. This was done by wiring the phone jack in parallel. The phone jack also acted as the power switch; removing the headset plug disconnects the battery. The power is supplied from a single "D" cell. The IC operates from 1.2 to 1.6 volts, and includes an AGC function in the circuit.

As his contribution to the project, the local heating and air-conditioning contractor sheared the sheet metal pieces out of his scrap bin. Our elmers folded the metal pieces and drilled the mounting holes (see Figure 2). The coil form was a piece of 3/4" PVC pipe. Pre-drilled holes for the terminals were made by twisting #22 AWG tinned copper wire "hairpins" and inserting them from the inside of the form, with the pigtail on the outside of the form (see Figure 3).

The breadboard chassis was cut from 1 x 4 lumber. The tuning capacitor guide was a 1/16" saw slot cut 3-1/2" from one end, and about 1/4" deep.

The tuning capacitor is like a bologna sandwich, with the bologna a rotor, and the bread a stator. The dielectric can be seen as a piece of notebook paper cut large enough to prevent the capacitor from shorting out when tuning. The tuning is accomplished by sliding the rotor.

During fabrication, the stator plates must have a slight bend at the fastening end. This compresses the plates when you fasten the screws, which keeps pressure on the stator plates and makes the "sandwich" tight (see Figure 4).

For easy driving, the students used #6 pan-head sheet metal screws 1/2" to 5/8" long. The screw holes were located and pilot-drilled by use of a template. This made the screws easy to drive. At age 12, not many children know how to drive screws, so the pilot holes provided a safety measure as well.

The terminal points for soldering were 5/8" brass-plated linoleum nails. These are placed by use of a template and driven in about halfway. The position of the brackets and coil were also located by template. This ensures a somewhat uniform construction. The "D" cell is held in place by a rubber band stretched across the two #6 penny finish nails (see Figure 5 for nail locations).

The coil was wound with #31 AWG enameled magnet wire. This was accomplished by rolling the coil form onto the wire, which is stretched taunt by fastening it to something (see Photo B) on one end, and pulling as you walk up to the fastened end. For the tuning

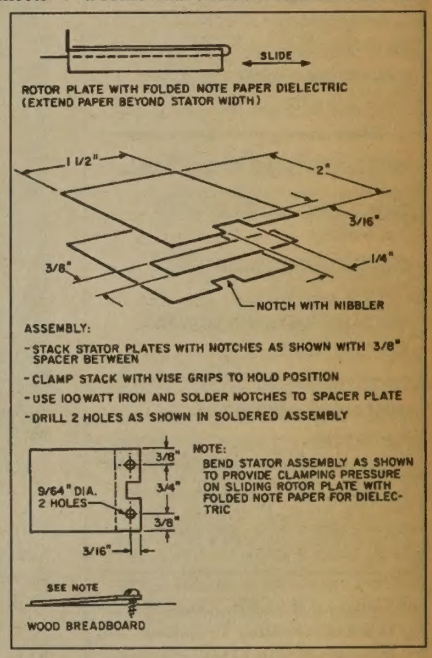


Figure 3. Construction of the variable tuning capacitor. Notepaper is used as shown to insulate the rotor and stator sections of the capacitor.

coil, #31 AWG wire was wound for 1-1/16" (approximately 107 turns), or about 35 feet. The antenna coil is about 15 turns, and can be omitted if broadcasting stations are within 25 miles. In Phoenix, in a moving automobile, you can pick up stations without the antenna if you hold the receiver close to a window.

Step by Step Construction

If you or your radio club or school group would like to put together your own building session, just use the following instructions (*Thanks to Pete Pederson W7KTK for the instructions and drawings.*):

1. The construction kit for each student is issued in four parts to avoid losing the components and to control the building activity.

Part One—Start with the wood breadboard (1"H x 4"W x 8"L), hardware, sheet metal pieces and the hookup wire. *You may want to saw the groove and pre-drill pilot holes for the screws before issuing the board to the students. Also, a sheet metal template of the brass nail positions will help the students mark the locations on their mounting board.*

2. On the bottom of the breadboard write the following information:

a. YOUR NAME c. INSTRUCTOR'S NAME
b. DATE d. SCHOOL'S NAME

3. Use a brass nail location template and mark the nail positions on the top of the breadboard.

4. Identify each tie point as shown on Figure 5.

5. Drive 10 brass nails and two #6 finish nails at the positions designated (see Figure 5).

6. Use #6 sheet metal screws and mount the phone jack bracket, two battery clips and the variable capacitor stator. Pre-drill pilot holes in the breadboard to aid in mounting the screws (see Figure 6).

7. Refer to Figure 6 and solder the hookup wire to the tie points, leaving the coil connections free.

Part Two—The Coil Form

8. Cut the tinned buss wire into four equal lengths of about two inches each.

9. Make "U" shaped hair pins with each of the four wires.

Photo C. The class tunes in with their new radios.

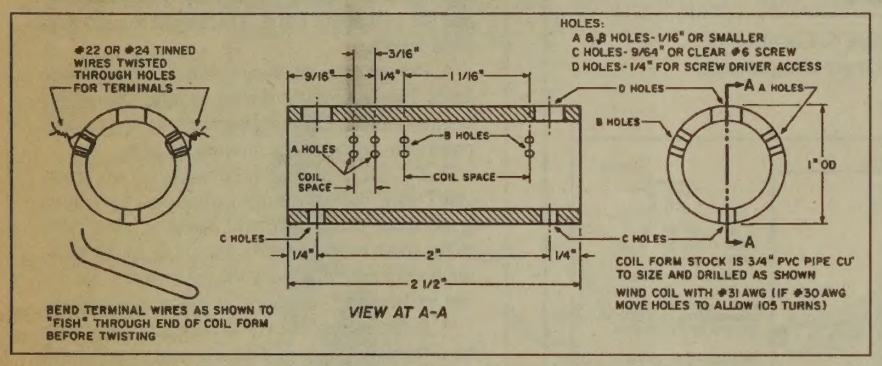


Figure 4. Coil form dimensions.

10. Curve the open ends to pass through the small holes in the coil form from the inside to the outside (see Figure 4).

11. Pull the hairpin tight and twist the ends to form a pigtail on the outside of the coil form.

12. Cut off the pigtails at 1/4".

13. Solder the pigtails carefully to avoid melting the coil form.

14. Unroll aprox. 35 feet of #31 red magnet wire and strip the insulation for two inches on one end, with sandpaper.

15. Wrap the stripped end around one large winding pigtail.

16. Stretch the #31 wire taut and begin winding 108 turns on the coil by rolling the coil onto the wire. Use caution to avoid losing tension on the wire, which will cause the coil turns to unwind.

17. Use a piece of masking tape to hold the turns in place when stopping winding action.

18. Strip two inches of insulation at the finish end of the #31 wire and secure by winding around the other pigtail.

19. Solder both pigtails again. This fastens both ends of the #31 wire.

20. Now perform the steps #13 through #18 with eight feet of red magnet wire on the smaller winding, making 19 turns.

21. Spray the finished coil with shellac to hold the turns of wire in place. Let the coil dry for 10 minutes and set it aside.

Part Three—The small components (three capacitors and resistors).

22. Solder the small components in place, using small hooks on the ends of the leads as shown. The wire leads can

Continued on page 8

what next?

Continued from page 7

be cut to the approximate length as shown (see Figure 7).

Part Four—Issue the Semiconductors (2N2222A and ZN414).

23. Refer to Figure 7 and verify the pin arrangements of the semiconductors and the resistor values.

24. Mount the semiconductors by soldering the ends of the leads to the top of the brass nails.

25. Mount the coil with #6 sheet metal screws and use #10 nuts for spacers.

26. Use Figure 6 and solder the four loose ends of the hookup wires to the coil form as shown.

27. Add a four-inch flexible wire, making a single loop from the coil to the rotor of the variable capacitor (see Figure 6).

28. Insert the "D" cell. Observe the correct polarity.

29. Add the paper dielectric insulator around the variable capacitor rotor and insert into the stator.

30. Connect the phones to the jack. This turns the set on.

31. Slide the variable capacitor rotor section along the groove to tune in stations.

32. You now have a working radio!

Success

The elmers could handle about three students at a time without too much confusion. It takes about four two-hour days to complete the receiver set. Pete and his fellow club members continue to be delighted with the tremendous self-confidence they see the children exhibit. There were a lot of "Wow, I did it myself!" exclamations from the kids as they played the sets.

If you are a member of a radio club, and you want to make a meaningful contribution to the lives of school children, you might suggest doing some demos or helping the youngsters build their own radio project. There's so much fun in getting involved with young people. Introducing them to ham radio will enrich both you and them.

As a result of their success with the radio projects, Pete and his club have been invited to do more demos in more schools. They recently raised $1600 from local service clubs, and were able to purchase some equipment and put together 16 sets of tools, including soldering irons, for donations to the schools. The mayor of their city declared an "Amateur Radio Awareness Day," and several of the children worked rigs from a mobile home to celebrate. So far, 15 of the kids have become licensed. What a terrific success story! RF

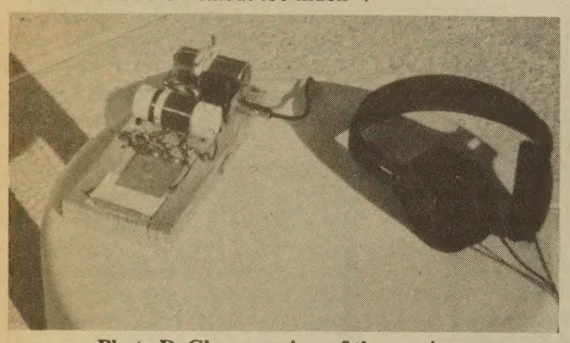


Photo D. Close-up view of the receiver.

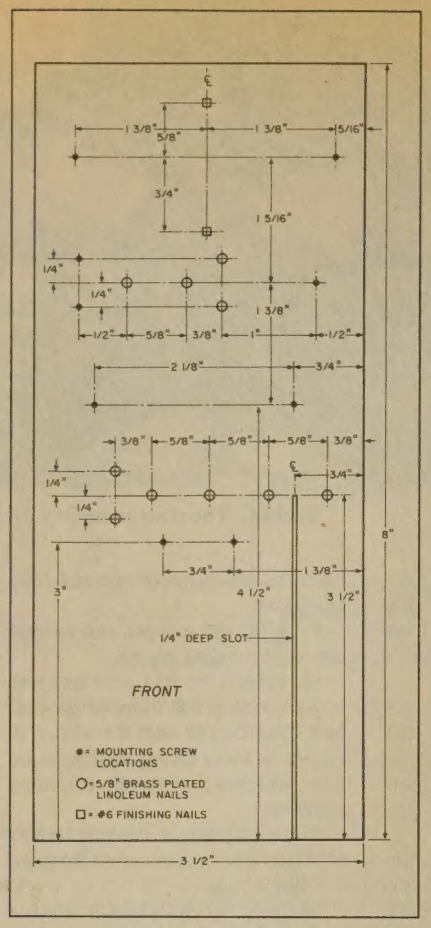


Figure 5. Mounting hardware location.

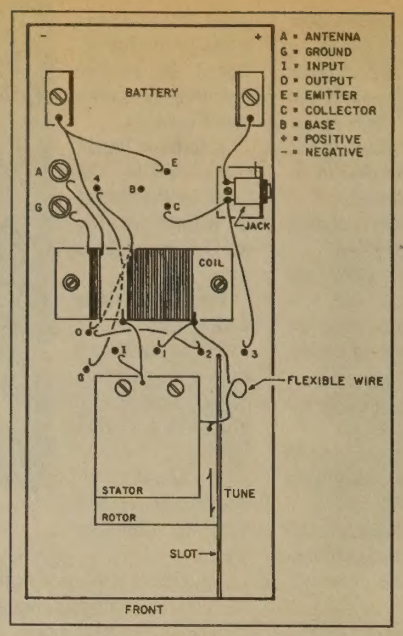


Figure 6. Location of the larger components.

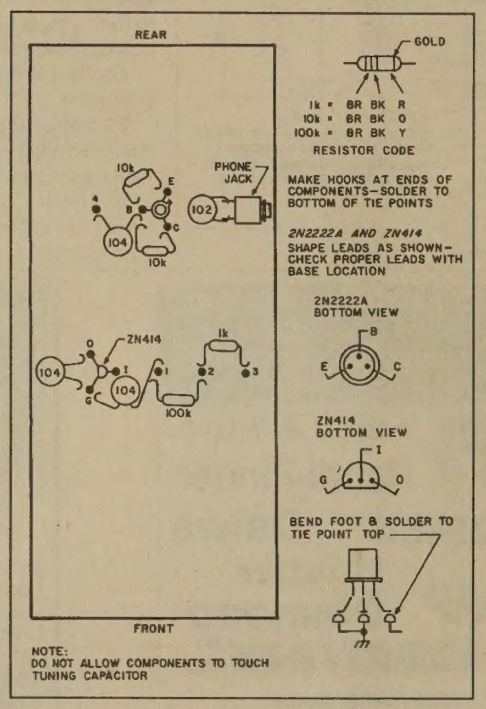


Figure 7. The small discrete components are soldered to the brass nails as shown.

Please send write-ups on interesting classes, recruiting ideas, youth club activities, or individual children's experiences along with photos, to Carole Perry at Media Mentors, Inc., P.O. Box 131646, Staten Island NY 10313-0006.

NiCds

The following product safety bulletin was issued by the Streamlight Flashlight Co. of Norristown, Pennsylvania, makers of high powered police-type flashlights. Although specifically addressing flashlight batteries, it also applies to amateur radios and other amateur equipment that depend on nickel-cadmium (NiCd) multicell rechargeable batteries and packs.

If a nickel-cadmium battery is subject to repeated and extensive over-deep discharges, such as an aggressive conditioning to eliminate "memory" (the battery running down completely on a regular basis), it can experience a voltage reversal of one of the cells. This can cause a buildup of pressure inside the cell, which could lead to venting of the electrolytes (positive and negative ions in the battery), cell damage, and early battery failure.

If the pressure relief vent on the top of the battery becomes damaged, pressure could build up and the cell could burst. This could lead to possible injury.

1. Do not over-discharge nickel-cadmium batteries. Never leave the device on after the voltage begins to drop. Discharging the battery past this point can damage it or shorten its life.

2. Do not periodically "condition" or "exercise" your battery despite what you may have heard about nickel-cadmium "memory." According to the most recent reports gained from the technical manuals of battery manufacturers, the actual existence of "memory" is extremely unlikely.

3. If the battery is over-discharged, there may be a small leakage of alkaline electrolyte from the safety vent area on top of the cell. It appears as a white, powdery substance and can affect the integrity of the electrical contact. We recommend that the battery be periodically inspected, and the contact area wiped clean should any evidence of electrolyte leakage be present. Use caution when handling a battery that has leaked. The electrolyte is a strong caustic, and can burn or irritate the skin and eyes.

4. While inspecting the battery, take note of the condition of the positive terminal cap. Some suppliers' batteries are subject to vent damage if this cap is dented. The battery should be replaced or serviced. Routine maintenance will enhance personal safety and battery performance.

If you want more information, you may write to Streamlight at 1030 West Germantown Pike, Norristown PA 19403.

Ham Radio on the Moon

Ready for vacuum-state electronics?

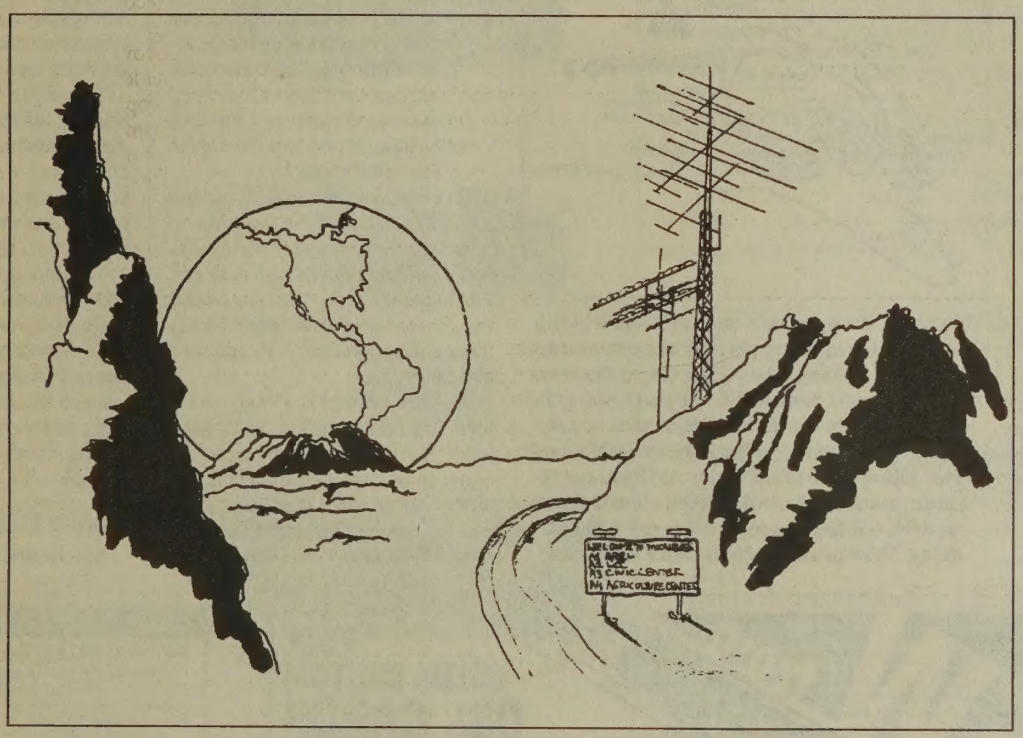
by Nick Leggett N3NL

People *will* return to the moon, and when they do, radio amateurs will be among them. At this time, NASA is studying plans for long expeditions to the moon and the establishment of a manned base. The Soviet Union and other nations are also looking to the moon. Radio amateurs can contribute to lunar exploration, just as they have contributed to the shuttle program.

Lunar Base Activities

Astronauts and explorers staying on the moon will live in small, pressurized habitats buried under several meters of lunar soil for protection from solar radiation, meteors, and the harsh conditions of the lunar surface. One of these habitats will house the lunar amateur radio station. There will also be some portable operation from the surface.

Amateur radio on the moon will provide public services similar to those it provides on earth—back-up emergency communications if the main system fails, and additional communications channels when needed. The lunar ham radio station will also offer morale-building communications with the astronauts' families, and educational contacts for school classes around the world.



Moon-to-earth communications will be easier, and require simpler equipment, than earth-to-moon communications.

Amateur radio experimentation on the moon will lead to discoveries about the lunar communications environment, and perhaps to the invention of new technologies, such as vacuum-state electronics.

Operating on the Moon

DXing will be easy, while local communication may be difficult.

DX communication to the earth will be direct line-of-sight contact. At any time, an amateur station on the moon will be within view of half of the earth, allowing VHF, UHF, and microwave communication. The required equipment is much simpler than what hams currently use for bouncing signals off of the moon because the path loss is much less. In other words, moon-base-to-earth communications will be much easier than moonbounce (EME) communication.

If you, the lunar operator, want to communicate with a station that's not within direct line-of-sight, just wait for the earth to rotate, and the station you want will come into view. Or, if you want to experiment, you can transmit an HF signal tangentially into the earth's ionosphere to relay your call to the other side of the earth.

As you can see, DX will be easy as long as the lunar base is on the side of the moon that always faces the earth. If the base is on the far side of the moon, your challenge is greater, because the earth is *never* in view for direct line-of-sight communication.

Communicating between points on the moon will not be as easy as talking to the earth. The moon does not have an ionosphere, so conventional shortwave communication will not work. Also, the lunar soil may be unsuitable for surface wave propagation because, having no water, its conductivity is poor. VHF and UHF communication is limited because the moon is a small world, its horizon a short distance away.

Point-to-point communication on the lunar surface requires a repeater. A lunar satellite would be ideal, but rather costly. The cheapest location for a long-range repeater would be the earth. Amateur stations on the earth could be set up to serve as repeaters for distant locations on the moon. Several stations throughout the world would be needed for continuous relay as the earth rotates. This repeater system would be quite practical if you didn't mind the propagation delay and would be willing to use directional antennas pointed at earth.

The first lunar ham station will probably use a very compact transceiver imported from earth. However, lunar amateur operators should reserve the right to experiment, because the moon offers excellent opportunities for new developments and inventions.

Experimenting on the Moon

The primary potential of the moon is vacuum-state electronics manufacturing. The natural environment of the moon is an excellent vacuum. You can build circuits where electrons travel freely through space for tens or even hundreds of meters. You could build vacuum tubes without the tubes to create your ham radio station. You could also be daring and create a large-scale "gymnasium for electrons," where electron beams are deflected and controlled by electrified wire-mesh screens. A klystron-type system for low-band operation should be possible. Similarly, an antenna could consist of a cloud of electrons moving back and forth between distant, charged plates.

The elegant resource of a large, pure vacuum frees the technical imagination of the amateur from the constraints of earthly electronics. Why keep currents to little wires and microchips when the currents can move through space itself? The greatest contribution from lunar amateur radio could be in this area of technical innovation and invention.

Let's Go To The Moon

Clearly, the Amateur Radio Service has much of value to deliver to lunar exploration and development. We must work to get amateur radio included in the plans for lunar exploration, development, and settlement. Then, when these plans are actually implemented, amateur radio will naturally be part of them. RF

Contact Nick Leggett N3NL at 1432 Northgate Square 2-A, Reston VA 22090.

Weather Nets

Save lives, promote amateur radio.

by William F. Blinn

"Even though we track storms with radar and have meteorologists on duty 24 hours a day, we still need the amateur radio community." That's what the meteorologist in charge, Lew Ramey, has to say from the National Weather Service station at Columbus, Ohio.

Ramey, who's been at Port Columbus since 1970, says amateur radio weather spotters are "eyes and ears" that augment NWS radar. "Even when we have the new Doppler radar," says Ramey, "we're going to need people on the ground to let us know what's happening."

There's no question that the time hams donate to weather nets around the country is time well spent and highly appreciated, but there's always room for improvement.

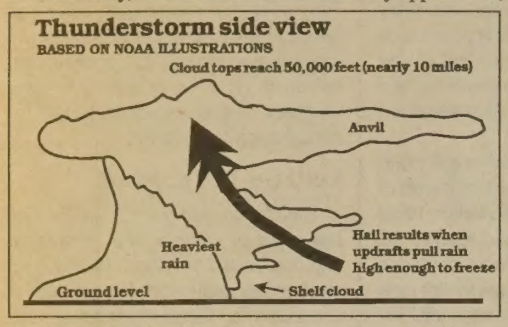


Figure 1. Cumulus clouds that spawn thunderstorms and tornadoes can tower 50,000 feet. Because hail is a sign of violence within the storm, the National Weather Service wants to know when it develops. Tornadoes are most likely to form following a thunderstorm with hail. Weather spotters need to be most alert as the sky clears following an intense storm.

"We can usually tell good reports from questionable ones," says Ramey, "so incorrect sightings aren't a problem for us. But they can cause embarrassment for the spotter." That's why most Weather Service stations schedule classes for weather spotters. In addition, most will loan training tapes to amateur radio clubs.

If you live where thunderstorms and tornadoes are an annual threat—and that's a large part of the country—you should learn more about them. This is knowledge that can save lives in your community. Maybe it will save your life, or that of a spouse or child.

What are the key points to remember? "Just tell us what you see," says Ramey, "keeping in mind how thunderstorms and tornadoes develop." Tornadoes rarely occur on the leading edge of a storm. The typical pattern begins with a gust front—winds sometimes exceeding 50 miles an hour—then rain, hail, and finally the tornado.

Straight-line winds that precede a tornado can topple trees and small buildings. These conditions can be deadly, but the overall severity of the damage does not approach that of a tornado. Straight-line winds occur during the rain/hail part of a thunderstorm.

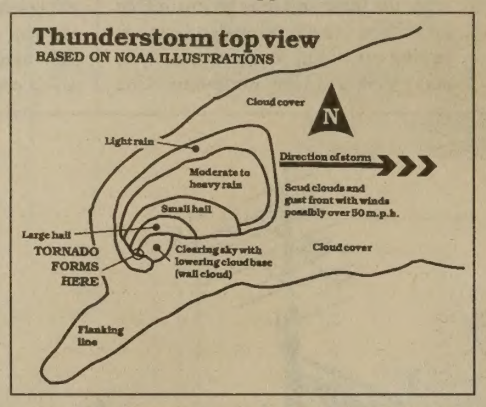


Figure 2. Strong clouds and ominous-looking scud clouds frequently precede thunderstorms, but it's the trailing edge of the storm that carries the greatest danger. Watch particularly for rotation in any low-flying clouds that appear to have dropped down from the general cloud cover following a thunderstorm. If you see rotation (counter-clockwise when viewed from above), tell the severe weather net without delay. Your prompt action could save lives.

Thunderstorms and tornadoes come from cumulus cloud towers, tall stacks that can rise more than 10 miles. Tornado-spawning storms develop through several recognizable phases:

1. Towering cumulus clouds—often with the appearance of a mound, dome, or cauliflower—set the stage.
2. Cumulonimbus clouds—dense and non-fibrous, with hard outlines—tower above cumulus clouds and mark the arrival of more serious conditions.
3. The upper portion of the cloud mass may display an "anvil," a spreading cloud that resembles a blacksmith's tool.

Hail is an ominous sign, frequently a harbinger of worse weather to come. It occurs when strong updrafts pull rain high enough to freeze. The larger the hail, the more violent the storm—and the more likely the weather system is to spawn a tornado.

Another bad sign is a "wall cloud" following a thunderstorm. Wall clouds are light in color and appear to descend from darker cumulus clouds. Some wall clouds are small and virtually invisible, so watch for rotation. Any rotation—even if it appears to be slow—means extreme danger. A tornado can be partially obscured by swirling the dust and debris it pulls skyward. Beware!

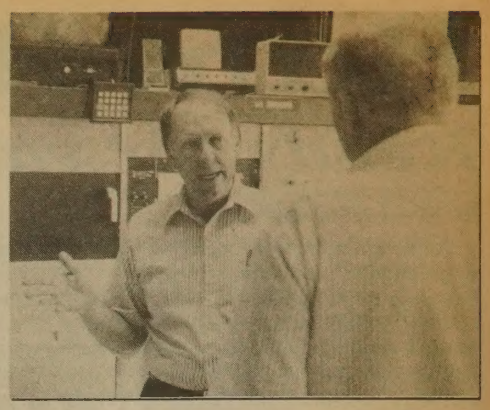


Photo A. Meteorologist-in-charge Lew Ramey explains the operation of the weather center to amateur radio operators who are attending a training session for weather spotters. The National Weather Service relies on timely information from hams to help interpret radar sightings.

Spotting a tornado at night is particularly difficult. Listen for a "freight train" sound as it approaches. You can even "see" a tornado at night if you know what to watch for: Energized power lines arc and transformers explode as the tornado hits them.

Tornadoes range in size from a few feet across to more than half a mile. A single tornado can split into two or more—and a multi-vortex tornado can merge into one. The tornado may remain on the ground for just a few seconds, or for over an hour.

In a word, tornadoes are unpredictable.

Beware False Sightings

Mammatus clouds look dangerous,

but aren't. These rounded pouches on the undersides of other clouds frequently accompany thunderstorms and can be mistaken for a wall cloud. They do not produce tornadoes, funnels, hail, or any other kind of severe weather. You'll find mammatus clouds on the leading edge of the storm and neophyte spotters often mistake them for dangerous conditions.

Rain shafts and rain columns can resemble tornadoes. When seen against a light background, the column of rain appears dark. There may be a turquoise hue. The color is often attributed to the presence of hail, but this is still not proven. As with mammatus clouds, rain shafts occur early in the storm.

Scud clouds are probably the most common causes of false alarms. Although harmless, they appear menacing. You'll find them on the leading edge of a thunderstorm—low-flying clouds that are not attached to higher clouds.

Making the Weather Net Work

The Central Ohio Weather Net (7:30 p.m. Tuesdays on the 146.76 repeater) is one of the largest in the country. Ten to twelve net control operators alternate in and out of the weather station during bad weather. The net holds a readiness check every Tuesday night from March through September. This way spotters are able to become familiar with how the net operates when weather conditions are normal.

Because several hundred spotters may be on frequency during a weather emergency, there is potential for chaos. Says meteorologist Ramey, "The net control operator's job may be harder than an air traffic controller's. Instead of being responsible for half a dozen aircraft, the net control operator must ride herd over hundreds of spotters. You don't want everyone calling in. You want just solid severe-weather reports—not 'sunshine reports' as some of the control operators call them."

The Central Ohio Weather Net makes guidelines available to its spotters. According to net manager Stew Banks, the following are among the most important.

Operations

1. Keep talk to a minimum. If you have nothing to report, don't report it; and if you can't see what's happening, don't guess. Just listen. "A good operator says practically nothing on the net."
2. Don't check in unless the net control operator specifically asks for check-ins from your specific area. "We know you're there," says Stew.
3. When you report severe weather, switch to the highest power you have. The "minimum power to communicate" rule does not apply in emergencies. Storms create a "receiver de-sense" that makes communications difficult. If you must use a handy-talkie, couple it with an external amplifier.
4. Think before you speak. Plan what you're going to say and be concise. Don't tie up the net; you may hinder other more important traffic.
5. Pause frequently in a long report to give other spotters a chance to break in.
6. The net control operator has two options at the end of a transmission: "OVER" asks for a response; "OUT" means no response expected or wanted.

Safety

1. If you're a "mobile" weather spotter, be "stationary mobile." Pick a spot where you can observe conditions safely and stay there.
2. Don't try to drive, watch a storm, and call in reports. You'll endanger yourself and others.
3. When you park near a road, get as far off the road as you can and turn on your four-way flashers. This reduces the chance that a motorist will think your stopped car is in a moving lane and rear-end you.
4. The weather net will NOT dispatch you, but the control operator may ask if anyone is in an area for which they need information. If you go, you're on your own.
5. The net control operator, however, will try to dispatch you away from deadly weather. If you're told to move, MOVE.
6. Never try to drive away from threatening weather if you're in a populated area. You may be able to escape a tornado this way in open country, but not in a metropolitan area. You'll be safest if you bail out of the car and dive into a ditch. Your car offers no protection and the glass is deadly.
7. Don't drive through a thunderstorm from east to west or try to go around it to the south. You will be driving through the heaviest rain and right into the path of the worst conditions. Always go around a storm to the north.

Continued on page 30

The Barnes Family

An unforgettable family renews the spark.

by Larry R. Luchi W7KZE

After teaching a 10-week Novice/Technician class every Wednesday night for the past five years, I was ready to hang up my mike and key as a volunteer instructor.

But this past spring quarter, I was fortunate enough to meet the Barnes family: June N7RIR (Grandma), Jack Jr. KG7SE, Elaine N7TGQ (Jack's wife), Carol N7TMZ (Elaine's sister), and eight-year-old Michelle N7TMU (Jack and Elaine's daughter). This active family was instrumental in renewing my commitment to teaching amateur radio.

The Barneses took advantage of the family rate and began my amateur radio course on April 17, 1991. Our classes are advertised through the Mukilteo School District Community Schools Bulletin, as I am an electronics teacher for the district. The Community Schools charge a small fee for registration, printing, and postage for the class offerings each quarter.

Class began at 6:30 p.m. Wednesday night with introductions followed by an ARRL video, *The New World of Amateur Radio*. After the video and discussion, the class was divided into three groups. Carle Graffunder WY7H introduced two groups to Morse code, and I took one group at a time on a tour of our "ham shack" located in the back of the classroom.

Organizing the Classes

The class received an overview of our Kenwood TS-830S HF rig and Dentron 2500 linear that drives the four-band, three-element Cushcraft A3 beam. Then we moved on to the VHF console and the IBM PC, which has many uses in the shack. First the students were shown a weather map on the EGA monitor, then, using our AEA PK-232 MBX data controller, we gave a demonstration on packet, RTTY, AMTOR, and Morse code.

At the center of the console is a Kenwood TS-790A, a three-band transceiver, which we used to demonstrate satellite communications through OSCAR. The TS-790A drives two RF Concepts amplifiers on 2 meters (170 watts) and 70cm (100 watts), and 23cm (10 watts), to three Cushcraft twister beams that track the "birds" using the Kansas City tracker installed in the IBM PC with N4HY Quiktrak software. Alignment is through a Yaesu G5400 rotor.

After the OSCAR demonstration, the students were introduced to amateur television, or ATV. To the right of the console is an AEA ATV transceiver connected to an AEA RLA-70 amplifier and a 16-element beam mount above the A3 beam.

After the tour and CW lesson, I described how the course was organized, and reviewed *Now You're Talking*, an ARRL study guide for the Technician license. Each week, students were given a 10-question open book quiz for homework out of the guide. The quiz covers basic electronic theory, and FCC rules and regulations.

Three members of the Barnes family: Elaine N7TGQ, Michelle N7TMU, and Jack Barnes, Jr. KG7SE, in the ham shack at Sno-Isle Skills Center.

The second and third week, I discussed a simple model of the atom, and the concept of current and voltage. (I have found that in an entry level class it is very important not to drag out the electronics theory.) Next, connecting a function generator to a speaker and an oscilloscope, all of the students were able to see and hear the frequency as it was increased from 60 Hz to 2 MHz. Then we went back to the ham shack to see a sine wave on the oscilloscope while transmitting into a dummy load on 10 meters.

This was the point at which Michelle, granddaughter of Jack Barnes, Sr., WA7KMR, started to show more interest in the shack. She said her grandfather had a radio like ours. During the fifth week, I discussed the concept of amplification using the oscilloscope, and Michelle participated in asking questions. The ages in this class ranged from eight-year-old Michelle to a 73-year-old retiree. As time when on, students participated more and more, with some of the adult students assisting the younger students.

Finally, week 10 arrived. Time for a full review of the past weeks of study and hands-on training. After the review, I explained the Volunteer Examiner program and the test coming up next week. During a break, Jack Barnes and I were talking, and I asked about Michelle's health, since at the time class started she had begun six weeks of radiation therapy. On ham class days, she normally went to school in the morning, had radiation therapy in the afternoon, and then came to ham class. This was a hard schedule for her and her mom.

Test Time

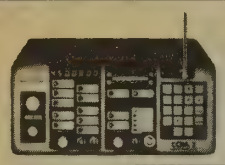
This class started with 45 students and ended with 43 completers. All of the Barnes family passed the Technician elements of the exams. Jack Jr. continued on with my Thursday night General/Advanced class and is now an Advanced class, with credit for the Extra class written exam.

Michelle is studying CW at home using Dad's PC with Super Morse, while Jack is teaching her the General theory. She recently attended the Kid's Fair at the Seattle Center as a participant in the Amateur Radio Booth. She was presented as an example of "You're never too young."

If you want to find Michelle, listen on 10 meters on the 146.92 repeater. As for me, I'll be in the classroom at Sno-Isle Skills Center teaching young and old alike *The New World of Amateur Radio*. RF

Larry R. Luchi W7KZE may be contacted at 11406—9th Place West #2, Everett WA 98204.

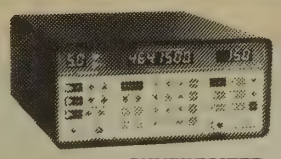
RAMSEY ELECTRONICS



COM-3 $279.00

2 WAY RADIO SERVICE MONITOR

COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantatic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features •Direct entry keyboard with programmable memory •Audio & transmitter frequency counter •LED bar graph frequency/error deviation display •0.1–10.000 µV output levels •High receive sensitivity, less than 5 µV •100 kHz to 999.9995 MHz •Continuous frequency coverage •Transmit protection, up to 100 watts •CTS tone encoder, 1 kHz and external modulation.



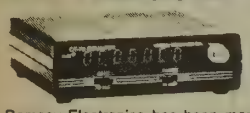
RSG-10 $249.00

SYNTHESIZED SIGNAL GENERATOR

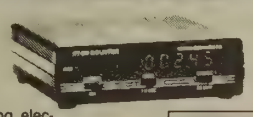
Finally, a low-cost lab quality signal generator—a true alternative to the $7,000 generators. The RSG-10 is a hard working, but easy to use generator ideal for the lab as well as for production test. Lease it for less than $3.00 a day. Features •100 kHz to 999 MHz •100 Hz resolution to 500 MHz, 200 Hz above • −130 to +10 dBm output range •0.1 dB output resolution •AM and FM modulation •20 programmable memories •Output selection in volts, dB, dBm with instant conversion between units •RF output reverse power protected •LED display of all parameters—no analog guesswork!

FREQUENCY COUNTERS

CT-70 7 DIGIT 525 MHz



CT-90 9 DIGIT 600 MHz



CT-125 9 DIGIT 1.2 GHz

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated-thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

NEW CT-250 2.5 GHZ

ACCESSORIES FOR COUNTERS

Telescopic ship antenna—BNC plug, WA-10	$11.95
High impedance probe, light loading, HP-1	$16.95
Low-pass probe, audio use, LP-1	$16.95
Direct probe, general purpose use, DC-1	$16.95
Tilt bail, elevates counter for easy viewing, TB-70	$ 9.95
Rechargeable internal battery pack, BP-4	$ 9.95
CT-90 oven timebase, 0.1 ppm accuracy, OV-1	59.95

ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	< 25 mV to 500 MHz	8	1 Hz, 10 Hz	$189.95
CT-70	20 Hz–550 MHz	< 50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	$139.95
CT-90	10 Hz–600 MHz	< 10 mV to 150 MHz < 150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	< 25mV to 50 MHz < 15 mV to 500 MHz < 100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	< 25 mV to 50 MHz < 10 mV to 1 GHz < 50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$239.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	< 50 mV	Convert your existing counter to 1.5 GHz		$89.95

SPEED RADAR $89.95 complete kit SG-7

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes delivery. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC.
PR-2, wired, includes AC adapter $59.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.
PA-1, 40W pwr amp kit ... $29.95
TR-1, RF sensed T-R relay kit . $ 8.95

FM WIRELESS MIKE KITS

FM-3 SHOWN

Pick the unit that's right for you. All units transmit stable signal in 88–108 MHz FM band up to 300' except for hi power FM-4 that goes up to ½ mile.
FM-1, basic unit ..... $ 5.95
FM-2, as above but with added mike preamp ..... $ 7.95
FM-4, long range, high power with very sensitive audio section, picks up voices 10' away $14.95
FM-3, complete unit includes case, battery, switch, antenna, and built-in condensor mike. Excellent fidelity, very small, kit $16.95
FM-3WT, as above, but fully wired and tested $19.95
SMC, miniature sensitive mike cartridge for FM-1, 2, 4 ..... $ 2.95

MICROWAVE INTRUSION ALARM

A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.
Complete kit MD-3 . $16.95

MUSIC MACHINE

Neat kit that will produce 25 different classical and popular tunes, plus 3 doorchime sounds. Lots of fun for doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look.
Complete kit, MM-5 ..... $24.95
Case + knob set, CMM-5 $12.95

PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software. PC board, all necessary parts and full documentation.
Complete kit, PC-1 .... $49.95

LO NOISE PREAMPS

Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.
Each kit $17.95

TONE DECODER

A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 $5.95

VOICE ACTIVATED SWITCH

Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED, or even a tape recorder motor. Runs on 9 VDC.
VS-1 kit. $6.95

TELEPHONE TRANSMITTER

Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!
PB-1 kit $14.95

NEW

SPEAKER PHONE

Talk on the phone hands-free, great to put in shop or shack, press the button to answer—no actual phone needed. Works same as commercial units. Talk from anywhere in room, phone line powered—no battery needed. Super for family and conference calls or buy two for hands-free intercom! Add our case set for a pro look.
SP-1 ..... $29.95 Case-CSP $12.95

TICKLE STIK

A shocking kit! Blinking LED attracts victims to pick up innocent-looking can—you watch the fun! Ideal for office desks, parties, nosey know-it-alls!
TS-4 kit . . $9.95

LIGHT BEAM COMMUNICATORS

Transmits audio over infrared beam up to 30'—use simple lenses to go up to ¼ mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug." Transmitter + receiver set, LB56 . . $19.95

FM RADIO

Full-fledged superhet, microvolt sensitivity, IC detector and 10.7 MHz IF. Tunes Std. FM broadcast band as well as large portions on each end. Ideal for "bug" receiver, hobby experiments or even as FM radio!
FR-1 kit $14.95

SUPER SLEUTH

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 8–45 ohm speaker.
BN-9 kit $5.95

BROADBAND PREAMP

Very popular sensitive all-purpose preamp, ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation.
SA-7 kit $14.95

NEW — FANTASTIC 2M FM TRANSCEIVER

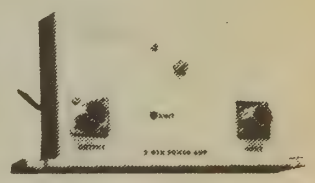
SYNTHESIZED—NO CRYSTALS TO BUY!

$149.95

Ramsey breaks the price barrier on 2 meter rigs! Here's the ideal rig for field days, hamfests, vacations, second cars and packet (it even has dedicated packet connections). Six expandable diode-programmed channels, 5W RF output, sensitive dual conversion receiver and EASY assembly. Why pay more for a secondhand old rig when you can make your own for less. Have some fun with your own truly AMERICAN-MADE FM rig! This kit comes complete except for the case, mike and speaker—ICOM or equal speaker-mikes plug right in. Add our own beautiful case set for a professional factory look.
FTR-146 kit $149.95
FTR-146-C metal case & knob set $24.95

2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.
PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested $79.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested $79.95



QRP TRANSMITTERS HAM RECEIVERS

20, 30, 40, 80M CW TRANSMITTERS

Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a $30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.
Your choice of bands $29.95
(Specify band: QRP-20, 30, 40 or 80)
Matching case & knob set, CQRP $12.95

20, 30, 40, 80M All Mode RECEIVERS

Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.
Your choice of bands $27.95
(Specify band: HR-20, HR-30, HR-40, HR-80)
Matching case & knob set, CHR $12.95

E-Z KEY CMOS KEYER

Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.
CW-7 kit $24.95
Matching case knob set, CCW $12.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!
AA-7 Kit $24.95
Matching case & knob set, CAA $12.95

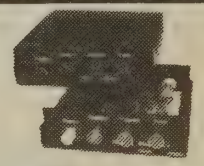
SPEECH SCRAMBLER

Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.
SS-7 kit $29.95
Matching case & knob set, CSS $12.95

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4–11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3–22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!
Shortwave receiver kit, SRI $27.95
Shortwave converter kit, SCI $24.95
Matching case set for SRI, CSR $12.95
Matching case set for SCI,CSC $12.95

2, 6, 10 MTR, 220 FM RECEIVERS

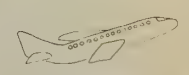


Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.
FM communications receiver kit $29.95
Specify band: FR 146 (2m), FR6 (6m), FR10 (10m), FR-220 (220 MHz)
Matching case & knob set, CFR $12.95

FM STEREO TRANSMITTER

Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!
FM-10 kit $29.95
Matching case set, CFM $12.95

AIRCRAFT RCVR



Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.
AR-1 kit $24.95
Matching case set, CAR $12.95

TERMS Satisfaction guaranteed, examine for 10 days. If not pleased, return in original form for refund. •Add 7% (up to a maximum of $10) for shipping, handling and insurance. •For foreign orders, add 15% for surface mail. •COD (USA only), add $4.50. •Orders under $20, add $3.00. •NY residents, add 7% sales tax. •90-day parts warranty on kits. •1-year parts & labor warranty on wired units.

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CIRCLE 34 ON READER SERVICE CARD

WWV Numbers for Short-Term Propagation Forecasting

How I learned to like HF.

by Glenn Carella N2GOP

Are you having difficulty making heads or tails out of the HF ham bands? Do the inconsistencies of our atmosphere make you crazy, whether you are trying to put a signal across town or across continents? Are you getting ready to throw in the towel, especially with the impending lull in the solar cycle?

DON'T DO IT! Things aren't as bad as you think, and Uncle Sam broadcasts a significant amount of information that will help you get a signal through the air. While some folks use computer programs, propagation charts and voodoo to guess what is happening, you and I are going to give a listen to radio station WWV in Fort Collins, Colorado.

What the Numbers Mean

In addition to time signals, WWV gives out other information at set times every hour. At 18 minutes past the hour it broadcasts a bulletin of solar information and terrestrial readings (in plain English—what the sun is doing and how planet earth is reacting to it). What you will hear is an announcer giving you the following information:

1) The solar flux number
2) The "A" index
3) The "K" index and
4) Geomagnetic field statement

Let's look at these items one by one. You'll see that it's not too hard to get a good idea of what is happening.

Before we start, be sure that you remember one point. WWV broadcasts on 2.5, 5, 10, 15 and 20 MHz. Each frequency will usually have a different strength depending on your location, and in some cases you may not even hear WWV on one or more of them, depending on conditions. The first step is the simplest—you check which frequency is the clearest. Now, let's play a different type of "numbers" game.

The solar flux reading is a value taken from measurements of solar-radiated energy around 2800 MHz. This tells the degree of solar activity, and the more the merrier. This value can be a number from 50 to 250 or greater, depending on sunspot quantity.

The "A" index is a number describing the degree of atmospheric absorption. A value less than 15 is helpful for HF communications since more of your signal will survive each bounce off the charged layers of the atmosphere.

When this number goes as high as 100 or more, you will be lucky to hear any HF signals at all (you may even wonder if your antenna is still up and hooked to your feedline).

The "K" index is a value between 0 and 9 that gives you an indication of the earth's geomagnetic field. The higher the number, the higher the degree of disturbance. With a "K" value higher than 3 you will have some real problems with the stability of HF signals, particularly if the other conditions are not favorable.

Finally, the WWV announcer will give a verbal statement that includes a forecast of geomagnetic conditions. The terms "quiet," "unsettled" and "active" are used to give you the state of the magnetic field around us, and their meanings are self-explanatory. For your purposes, understand that a "quiet" geomagnetic field is most desirable, and things can start getting strange when the reading is "active." If conditions become "stormy" you can even see the auroras at lower latitudes. These conditions start making things interesting at the VHF frequencies.

Using the Info

The one point that has to be emphasized here is that the ability to get a signal across the country or the world depends on all the above factors at any given time. A favorable solar flux number means nothing if the absorption is extremely high. At the same time, an active to stormy geomagnetic field may enhance the signals from a given part of the world. The WWV atmospheric indices and solar flux statements are a readily available resource being broadcast 24 hours a day.

In the event that conditions are really evil and you can't hear WWV on any of its assigned frequencies, just pick up your telephone. The phone number for atmospheric information is (303) 497–3235. To hear the time signal itself call (303) 499–7111. You can get more information by mailing your request to: The National Institute of Standards and Technology, Radio Station WWV, 2000 East County Road 58, Fort Collins CO 80524.

If you live in Hawaii it is more likely that you will hear WWVH. Their address is: Radio Station WWVH, P.O. Box 417, Kekaha, Kauai HI 96752.

In summary, while successful HF communications are dependent on many related factors, you have a ready source of timely information being broadcast 24 hours a day. By checking out the numbers and then listening around the bands, you can get an idea of what it all means. The art of predicting atmospheric propagation involves many different forms of information gathering, scientific analysis, Ouija boards and voodoo. Our tax dollars are hard at work as you read this now. Take advantage of the services of WWV. RF

Contact Glen Carella N2GOP at 62A Ridge Road, Valley Cottage NY 10989.

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The Ultimate Keyer!

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upgrade... don't stop now!

by Gordon West WB6NOA

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Bird Hunting

Get off to a good start.

by Kenneth J. Pietrucha WA2OKZ

No, I'm not an ornithologist, but some of the birds I do track, chirp, and a number of them actually talk. The birds I'm referring to are satellites that fly hundreds of miles out in space. I use the term "satellite" loosely, as it covers a variety of objects circling the earth. Some, like the weather satellites, are real satellites, while the Russian spacecraft *Mir* is unique. Then there are all those spent booster rockets and other space junk. Since the Soviet satellite *Sputnik 1* in 1957, man has launched thousands of objects into space. The moon is earth's only natural satellite.

Why Would Anyone Want to Track Satellites?

There are many reasons why you might consider satellite tracking as a side hobby. First of all, even the most experienced scanner enthusiast gets bored and wants to listen to something different. You have to admit, this is different. The NOAA series of weather satellites is one of my favorites. These satellites, and their European counterpart the Meteor series, have signals that can be heard between 137–138 MHz using only the rubber duck on your hand-held scanner. The signal you hear is from the automatic picture-taking system that is on board each of these satellites. Many people like yourself regularly receive photos of our earth directly from space, and the cost of the equipment does not require a second mortgage.

How about monitoring *Mir*? This beauty has been monitored regularly on 145.55 MHz in the 2 meter amateur band transmitting packet at 1200 baud. The crew does have work to do, but even when they are not playing radio games, they leave their equipment on, so that hams on the ground can use the spacecraft as a digipeater. Hams can also access the on board store and forward mailbox. The spacecraft has also been known to circle the Earth with an open mike on 143.625 MHz. This is the frequency used for low priority communications with the tracking ships at sea. Once again, these signals can be heard with your scanner and rubber duck. As with anything that you monitor, an outside antenna is always better.

And then, don't forget the OSCAR ham radio satellites. *[Ed. Note: OSCAR stands for Orbital Satellites Carrying Amateur Radio.]* Most of them have strong beacon signals. If you have single sideband (SSB) receive capability, you can monitor the hams using these satellites for amateur communications. Some of the OSCARs have a digi-talker on board, and regularly transmit voice bulletins on 145.825 MHz to us earth-bound inhabitants. A digitalker on this frequency was used to relay information during the Ski-Trek across the pole a few years ago.

Don't Forget to Look Up

For those of you who might want to try your luck on some visual observations, let me assure you that it's entirely possible to see quite a few satellites almost every evening. The *Mir*, for example, weights 21 tons. It's 43 feet long and 14 feet wide, with six docking ports. The solar panels extend to 100 feet. Believe me, with all that area it looks like a bright star in the evening sky.

It's Easier to Find If You Know Where to Look

You could keep your radio on all the time and scan the satellite frequencies, but it's easier to look for these satellites when they're predicted to pass over. With satellite-tracking software, it's easy to make predictions.

When I decided to write this article, I first looked around for a program that would go with the project. It had to be relatively easy to use and reasonably priced. After reviewing everything I could beg, borrow, or steal, I decided on a program called SATRAK V 5.38. The menu-driven program, written for the IBM-PC, comes with a four-page manual on disk.

To set up the program, you need only to input your latitude, longitude, and your altitude above sea level. Then, as soon as you input your current orbital elements (more about that later), you're ready to go.

What This Program Does

For what this program costs, it's a class act. It started out as the AMSAT Orbital Prediction Program, written by Tom Clark W3IWI, the man who wrote the original tracking programs for radio amateurs, and it ended with the additional work of H.A. Jones WB8AMI. It is not shareware, and you don't have to send any more money if you continue to use the program. This program is free for non-commercial use, and this is stated in the opening screen.

After you run the program, the main menu will appear on the screen. The options will allow you to update the coordinates for your area, and run the program in one of several modes. You begin by selecting the satellite that you want to track from another menu. It looks like you can store orbital elements for about 100 satellites. After you choose your satellite, you have to decide how often you want the computer to update the information. Since most satellite passes average 10 to 15 minutes tops, I usually get the information updated every one or two minutes.

What the computer gives you is the azimuth, or the number of degrees clockwise from true north where the satellite will be in the sky, as well as its elevation, or number of degrees above the horizon. So at zero degrees, it's just at the horizon, and at 90 degrees, it's directly overhead. If your data said to look at an elevation of 45 degrees, and at an azimuth of 180 degrees, you would be looking toward the south, halfway between the horizon and a point directly overhead. This would be 45 degrees, half of 90.

There will be a difference between the north that you measure with your compass, and true north that the program uses. The best way is to use the north star for a reference, and note the correction needed from magnetic north. Your eye and your antenna see such a wide view of the sky that even if you used your compass as the reference, you would probably find your satellite. A negative elevation means that the satellite is below the horizon.

This program, like most of its kind, will ask you for a default elevation for calculation purposes. Most of the time I use -5 degrees, so that the program starts calculating just before it goes over the horizon. Other data shown on the screen include the range and altitude in kilometers (km) from your location to the satellite, and the satellite's current location using earth-bound latitude and longitude.

Photo A. Track of the *Mir* space station. The orbit starts over the Indian Ocean and crosses the East Coast of the U.S.

If you like the program so far, the best is yet to come. Pressing the F9 key puts a flat map of the world on the screen. A blinking cursor shows the position of the satellite. If you watch the map long enough, you will see that as the data is updated a "+" cursor remains behind to mark the old position, and a plot of the orbit is generated. The data is presented on a split screen, with the satellite's current data given just below the map. You can view any satellite on which you have data, and you can view up to eight satellites at a time. Like any good program, pressing the escape key puts you back into the menu.

What Are Orbital Elements?

This information is often referred to as Keplerian elements. Your computer needs this data to make the software work. The ground work for defining the position of a smaller body revolving around a larger body was originally defined by Kepler over 100 years ago. We will be using a subset of Keplerian data which includes the following information.

Looking at a new set of elements for the first time, the first thing I look at is the inclination. This tells me how high in latitude the satellite will come. The Hubble telescope, for instance, has an inclination of 28.46 degrees. This tells me that the satellite will travel approximately up to where Texas meets the Gulf of Mexico, just to where the northern part of Florida begins, at latitude 28.46. From this one element, I know that the satellite will never make an overhead pass in the New York area. At best, it will come only a few degrees above the horizon here in New Jersey. If I lived in Florida,I could look forward to observing it on an overhead pass some evening, and I bet it's a beauty.

RAAN: Also referred to as the Right Ascension at Ascending Node, this is the longitude in degrees where the satellite crosses the equator going from south to north. Don't forget that the satellite has to cross the equator again, and this time it will be coming from the north and going south, toward the descending node.

Eccentricity: Pertains to the "roundness" of the orbit. A perfectly circular orbit would have an eccentricity of 0. It would always be the same height above the earth, with no minimum or maximum distance from the earth. Most of the satellites in which I'm interested have eccentricities of approximately 0.0018. Amateur satellite OSCAR-10 has an eccentricity of 0.69, while OSCAR-13 is at 0.753 at this time.

Sometimes it is desirable to have a highly elliptical orbit. As the satellite moves out to the furthermost point from the earth, it slows down, giving those on the ground longer access time. It speeds up as it reaches the point closest to the earth. A straight line would have an eccentricity of 1, but a satellite with this eccentricity wouldn't get a chance for a second orbit.

Argument of Perigee: Unless the satellite has an eccentricity of 0, it will have a minimum distance from the earth called perigee, and a maximum altitude called apogee.

Picture in your mind a line from the center of the earth to the satellite, when the satellite is at perigee, or closest to the earth. This line makes an angle with the equator at the point where the orbit crosses the equator. This angle is our argument of perigee, and it is measured in degrees. It is a time-dependent element, measured at the epoch time and reference orbit.

Mean Anomaly: This is another time-dependent parameter which defines the position of the satellite in terms of the number of degrees from perigee, at the time of the reference epoch.

Mean Motion: The number of orbits, measured at perigee, that the satellite makes in 24 hours, or one solar day. It consists of a whole number followed by a decimal part of an orbit.

Decay Rate: The rate at which the mean motion is changing. It is used as an indication of the effect of atmospheric drag on the satellite. A positive number indicates that the satellite is speeding up and falling. Some satellites have a negative number. Satellites way out in space, with very low decay rates, may circle the earth for hundreds of years. Decay rate is measured in + or - perigees per day/per day.

Epoch Revolution: The orbit number at the time of the epoch reference. All the tracking programs I have used calculated the current orbit number.

Element Set Number: Indicates the order that the element sets are put out. I normally put the element set number after the catalog number if the program doesn't have a special place for it.

Catalog Number: All objects in space are cataloged by a number assigned by NORAD's Space Defense Operations Center. SPADOC is located deep within the Cheyenne Mountain in the Colorado Rockies. The tracking branch is known as the Space Detection and Tracking System, or SPADATS if you prefer. At this time we have passed catalog number 21225, which was assigned to the Gamma Ray Observatory satellite, or GRO. Most programs will have a space in the data file not only for the name, but also for the catalog number of the satellite. It's the only way to make sure that we are all talking about the same object. As an example, amateur satellite OSCAR-21 is also called RS-14, RADIO-M1, and RUDAK-2. To avoid

any confusion it is also known as catalog number 21087.

Locating Sources of Orbital Elements

Depending upon your reason for tracking satellites, I would like to offer the following sources.

If you only want to track satellites that are primarily of interest to amateur radio operators, I recommend you get involved in packet radio. Orbital elements are posted regularly on all the packet BBSs I checked. If you're not into packet, you can still get orbital elements free from NASA. Write to them at this address: NASA-Prediction Bulletins, NASA Goddard Space Flight Center, Code-513, Greenbelt MD 20771.

When I first started to track satellites, NASA would send me a large brown envelope each week with updated elements. I used this information for over two years, and it was always free. The postman always looked confused, like he was trying to figure out why I was so important that NASA would send me information each week in a plain brown envelope.

If you're into all-round general tracking, and if you have a modem, you can get your elements from the Celestial BBS, Fairborn, Ohio, (513) 427–0674. Several other BBSs that have element sets, space news and satellite related activities, are the DRIG (Dallas Remote Imaging Group) BBS at (214) 394–7438, the RPV Astronomy BBS at (213) 541–7299 and the Canadian Space Society BBS at (416) 458–5907. A couple of different public domain tracking programs are available from both the Space and the RPV BBS.

For those of you with neither packet nor a modem, and also for anyone who takes tracking seriously, I suggest you write to: Jim Hale, HCR 65, Box 261-B, Kingston AK 72742. Include an SASE with $1.00 and request a copy of "The Amateur Satellite Observers Newsletter." Jim's newsletter covers a variety of topics, such as what's in view for the month, satellite history, what might be ready to come down, plus many selected orbital elements for you to play with. He also sells a fine selection of software for tracking at a reasonable price. Jim's been doing this since he started tracking satellites on a Timex computer.

Probably the biggest supplier of satellite tracking programs is AMSAT. When I first started to track satellites on my old Atari 800, AMSAT was the only one who could supply me with a program.

They have prices for members and non-members. The difference in price is usually close to the cost of membership, and with the membership you get a newsletter. AMSAT is also a source of orbital elements. It's always a good idea to enclose an SASE when requesting information from these sources. You can call them direct at 301–589–6062, or write to them at: AMSAT, P.O. Box 27, Washington, DC 20044.

AMSAT has the best value for your money. Their *Quiktrak* program, for example, has a color map of the world which can be configured from CGA to VGA. They carry another very powerful tracking program called *InstranTrak* which has a number of spectacular displays when used with an EGA or better graphics card. When tracking satellites on the map, the satellite marker is enclosed in a circle. The size of the circle indicates how much of the earth the satellite sees. There is also a line to indicate the transition from night to day, as well as a marker to show the position of the sun.

Almost all programs, including the free SATRAK program, have provisions for calculating Doppler shift. Just as a train whistle seems to change in pitch as an approaching train speeds by, so to does the frequency of the satellite you are receiving. Since you are only going to be monitoring the satellites, Doppler shift should not cause you any problems. If you were trying to get some information from one of these birds, you would have to continuously retune your receiver as the satellite passed overhead. The newer programs from AMSAT not only calculate Doppler shift, they are also capable of controlling the receiver through the serial port of your computer and automatically do the tuning for you.

Where to Start Monitoring

To help you get started with your satellite monitoring, I have listed some of the more popular active satellites. See the table. Keep in mind that the satellites are controlled from the ground, and are sometimes turned off for days at a time.

This should start you off on the right foot. While you are waiting for your tracking program to arrive, you might want to experiment with these frequencies. After you enter them in your scanner, plug your tape recorder into the earphone jack and put the recorder on VOX. Let it scan during the night or when you are at work. If anything shows up on the frequency, the tape recorder will turn on and record it.

Getting Your Tracking Program

I have given you more than enough to get started. You should have a good understanding of what's up (pardon the pun), and a list of frequencies to monitor. Next, contact your favorite shareware house and locate a copy of SATRAK V 5.38. You might even find something better. If you have any problems locating a program, send me a check or money order for $6.00 and I will make you a copy of my working disk. Please specify a 5.25 or 3.5 floppy. Send to: Kenneth Pietrucha, 610 Springfield Ave., Cranford NJ 07016. *[Ed. Note: SATRAK as well as a couple of other public domain tracking programs can be downloaded from the 73 BBS at (603) 525–4438. Look under the* 73MAG *file area.]*

Additional Reading

I can guarantee that any book you find on satellite tracking is going to be loaded with high level mathematics. The exception to this rule are the publications of the ARRL, and even some of these contain algebra. It's impossible to adequately describe satellite motion without some math, and the ARRL publications have kept it to a minimum. Either find yourself a good electronics store that handles ARRL books, or write to the League and request a list of their publications: American Radio Relay League, 225 Main Street, Newington CT 06111.

In *73 Amateur Radio Today*, there's Uncle Wayne's Bookshelf. Check this issue of *Radio Fun* for a partial list of the books you can order from Uncle Wayne.

I recommend that you consider these books for your library: *The Satellite Experimenter's Handbook*, by Martin Davidoff K2UBC; *Space Almanac*, by Anthony R. Curtis K3KXK; *Communications Satellites*, (3rd Edition) by Larry Van Horn; and *The Weather Satellite Handbook*, (4th Edition) by Dr. Ralph Taggart WB8DQT.

73 and happy hunting! RF

Kenneth Pietrucha WA2OKZ, 610 Springfield Ave., Cranford NJ 07016.

satellite frequencies

Satellite	Frequency	
NOAA-9	137.62	
NOAA-10	137.50	
NOAA-11	137.62	
NOAA-12	137.50	
FENG-YUN-1A	137.795	
MET-2-14	137.85	
MET-2-15	137.85	
MET-2-16	137.40	
MET-2-17	137.30	
MET-2-20	137.85	
MET-3-4	137.30	
MIR	143.625	VOICE
	121.750	VOICE
	166.125	TELEMETRY
	145.55	VOICE
		OR PACKET (1200 BAUD)
UO-14	435.07	
UO-15	435.120	
AO-16	437.025	
AO-17	145.825	DIGI-TALKER FREQ.
AO-18	437.075	
AO-19	437.150	
LUSAT	437.125	

radio magic

by Michael Bryce WB8VGE

Getting Informed

Purchasing your equipment can become a chore. There are so many different types of radios, from so many different manufactures, that you can become lost very early in the game. What to do? Well, arm yourself with back issues of *QST* and *73 Magazine*. What you really want from these magazines are the equipment reviews. The older the radio, the easier it is to find out how well it will perform in your station. Why? Because if the radio has been around for some time, you can look up the product review, and later on any modifications that people have done to make the radio perform better.

A good example of this is the Heath-Kit DX-100. When Heath sold the DX-100, it was quite a piece of gear (and still is, as a matter of fact). However, the "hams at Heath" did drop the ball in a few areas in the DX-100's design. What came next was a flood of modifications for the radio. So many, in fact, that Heath incorporated most of them in the newer, updated version called the DX-100B.

You can find old magazines at your radio club or public library. You may also be able to purchase some of the issues right from the publisher. Fill up the battle wagon with a good, solid source of information on the model you're after. Some of the product reviews that I have read in the past saved me a lot of time, money, and hair-pulling.

Being Flexible

Allow some room to change your mind. Don't settle on just one model or make. Allow yourself some leeway in your decision. Do you really have to have the Collins receiver, or will a Drake R4A suit the bill? Some of the really fancy radios add a lot of bells and whistles, while doing very little to improve the performance of the radio. Don't pay extra for a receiver that has a built-in RTTY (radio teletype) filter if you're going to use the radio just for the Novice subbands.

Vintage and Value

As mentioned in the first part of this series, decide which vintage of radio you would like to set up in your shack. As a general rule, the older the radio, the cheaper it will be. This is very true, but beware of the collector. He is after *all* your money.

I have what is called a Harvy Wells Band Master. This 80-2 meter transmitter is crystal controlled and runs about 40 watts output. Both CW and AM phone modes are supported. I was given one by Perry W8AU some time ago. I had to build up a power supply for it and do some troubleshooting, but I did get it to work just fine.

Once I was at a hamfest looking at all the equipment and came upon a Harvy Wells. The owner, who collects old radios, wanted $175 for it. OH-MYGOSH! I would have given him maybe $20, but nothing even close to what he was asking for. Why was he so expensive? Because the Harvy Wells is becoming a collector's item. And it's really not that great of a transmitter, either!

Be forewarned, the collector will price his wares for maximum profit. He will ask for whatever the market will hold.

Buy It Busted

There is one more place to look for gear: the hurt locker, as I call it. In today's high tech times, a lot of people are buying radios that they can't fix when they break down. Instead of returning the radios to the repair center of the manufacturer, they elect to just bite the bullet and sell the radio at a hamfest. That sounds a bit odd, doesn't it? Why sell the radio at a loss when you can send it in to be repaired?

Well, many times the repair centers will charge MORE than the radio is worth! And there is the possibility that the manufacturer is out of business. Swan, Atlas, and many, many other manufactures have come and gone. You can pick up a Swan 500CX really cheap if it is not working. If you're handy with a VOM, and have a good head on your shoulders, you can save a large amount of money by looking for dead radios, fixing them up, using them for awhile, and then reselling them.

Evaluating a Rig

Now that we have some of the finer points out of the way, let's get back to purchasing a radio. You really have the hots for a Yaesu, say. OK, good radio. You would like a Yaesu FT-101E. After what seems like hours, you find one, in a little rough, but not beat, condition. Before you get your money out, take a good look at the radio.

Continued on page 27

CIRCLE 184 ON READER SERVICE CARD

CIRCLE 5 ON READER SERVICE CARD

CIRCLE 264 ON READER SERVICE CARD

CIRCLE 83 ON READER SERVICE CARD

CIRCLE 234 ON READER SERVICE CARD

A DXpedition Adventure Guide

Turn your vacation into a challenge.

by Stephen Werner KE4BM

Photo A. Our beachfront cabana.

Many of Wayne Green's editorials in the past have covered travel and the benefits to be gained by operating overseas. Some of those benefits include hearing a pile-up from the other side, getting lots of QSL cards, and having a real adventure.

Over 25 years ago, when I received my first license, I thought it would be quite an experience to operate from a DX location. During the '60s a DXpedition was a considerably more challenging event than it is today. Large tube rigs were far less easy to transport due to their size and weight. Today, with just a little planning and an understanding wife, it's possible to have an exciting DXpedition that you will never forget.

Choosing a Location

My first inclination was to try to arrange to operate from a station already set up in another country. Several of these are advertised in the ham magazines and might be a good way to get started. However, this method will greatly limit the number of choices available to you.

We were long overdue for a nice vacation so Kathy, my wife, began surveying travel agents for some ideas. She wanted a quiet place (no kids, we have four at home), not a tourist trap, and plenty of water sports. After two weeks of looking and a few fair ideas, I came home from work in mid-March to find that the travel agent had sold her on the idea of Belize. She had not even heard of it before.

To me it was V31, a Central American country I had worked several times in the past, but I'd never received a QSL card. With over 100 countries confirmed, I knew others might be in the same situation. After reading about the island of Ambergris Caye, off the coast of Belize, it began to sound like the making of a real adventure.

I wrote to the ARRL for information on reciprocal licensing and several days later a very informative data package arrived. Someone had obviously done a lot of legwork in the past because it answered 95 percent of my questions concerning overseas operation.

On March 26 I sent a letter requesting a reciprocal license, including all the information described in the ARRL package. We picked a resort, Ramon's Village, and made reservations for a beach-front cabana for five nights starting May 25. Ramon's offered individual cabanas with plenty of palm trees and tropical plants. This would make it easy to install a simple dipole wire antenna, a feat that wouldn't have been so easy in an American-style hotel or motel setting. Ramon's also had a great beach and a first class restaurant.

Preparing for the Trip

I then began planning what equipment I would take. At home I operate all bands and all modes, but my station is not elaborate on any band or any mode. I enjoy HF contesting, RTTY, and satellite operation the most, but have also done some packet and SSTV operation. On most vacations in the U.S. I bring my 2 meter hand-held unit. This is great for long drives, as most of the U.S. is covered by repeaters now. My wife thought that was what I had in mind when I sent for the V31 license.

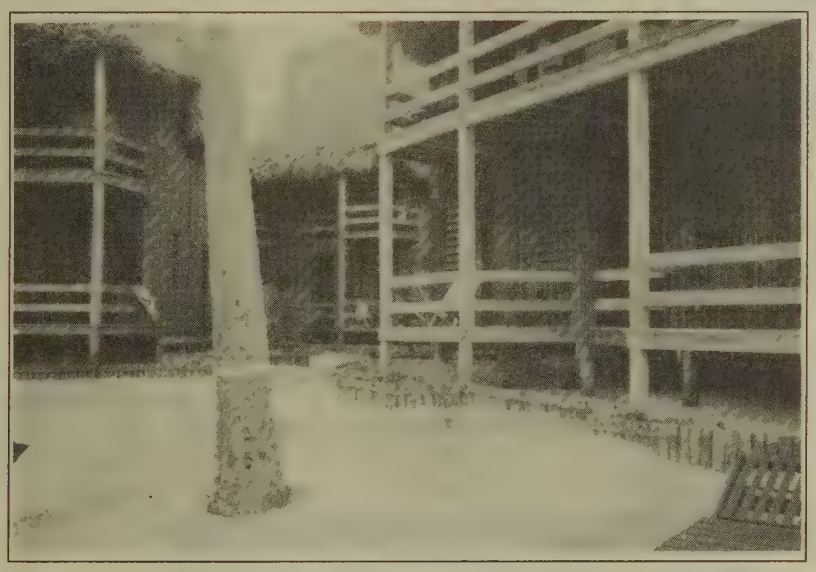

Photo B. The hamshack.

After considering my equipment weight and size, I decided to bring a minimum station for 10–20 meter operation. This included my TS-430S and two dipole antennas. Dipoles for 40 and 80 meters would be too long for easy erection, and 10–20 meter operation would still provide for day and night operation. RTTY equipment was out of the question due to the size constraints. (Perhaps I could have borrowed a laptop computer to use with my KAM all-mode TNC.) A linear amplifier would be too much extra weight to carry and would really not be needed. Lower power would also reduce the chance of interference problems at any resort.

In mid-April I received a request from the Office of Telecommunications in Belize for a new check for the license because the granting authority had changed names. My level of concern began to grow as I only had six weeks left. I filled out the new application they sent and included a new money order. In the meantime I built a wooden chassis to protect my open-frame AC power supply and made two dipole antennas for 10 and 20 meters.

On May 10 I began to panic and called the Director of Telecommunications in Belize. He told me I had been issued V31BM.

Kathy was now beginning to get a clear view of the reasons behind my claim for luggage space. We made a final compromise over luggage space. Table 1 lists the items that should help anyone intending to make a trip like this.

Fortunately, Belize uses U.S. power standards. Check this situation before you go.

On the day before we had to drive to New Orleans to catch the Taca flight I still had not received the license. I called the Director again and was happy to hear that he was willing to FAX me a copy of the license and equipment import permit. I can't thank him enough for helping me with this. I obviously cut it too close on the licensing, and I highly recommend at least a three month head start.

I also recommend that you buy travel insurance for your baggage. For very little money you can cover your rig and have peace of mind while you are en route, or out sightseeing after you arrive. The rate is based on days of travel and the total value of your belongings.

The flight on Taca to Belize was uneventful. The customs people entered my equipment into my passport (to make sure that I took it all home with me) and compared it with my import permit. They also made sure that I had a valid license. Do not try to bring equipment into any country without a valid license.

Setting Up and Operating

After clearing customs we waited for the flight on Maya Air to Ambergris Caye, and arrived in time for dinner. After dinner I tried to put up the 20 meter dipole. I used fishing line to secure the ends of the dipole and a ball to throw it over trees. The resort had a guard who did not quite understand why I was stringing wires in the dark. The initial try had an SWR of 3:1, so I took it back down and figured I'd try again the next day.

In the morning I woke up early and put up the 10 meter dipole in an inverted "L" configuration on the front of the cabana. It wasn't mounted very high but it had a good SWR and worked surprisingly well. I generated some real pile-ups. It was easy to tell when I was entered into one of the DX packet networks.

The AC voltage at Ramon's Village averaged 102 volts at night and 107 volts during the day. Not as many homes had air conditioners as I expected, explaining the higher daytime voltage. Our cabana did not have an air conditioner; the constant breeze made it unnecessary. The power did go off twice during our stay for a short period of time.

The following day I got the 20 meter dipole working. I ran it out to a tree and used it at night. Be sure to bring headphones—with all the open windows, other guests might not enjoy the pile-ups late at night. Later during the visit I shortened the 20 meter dipole and used it on 15 meters. In between DXing sessions I had a great time snorkeling during the day, and once at night, in one of the best diving spots in the world. They also have great sport fishing. I had a good time bone fishing.

Home Again

Upon our arrival back in the States, I faced a situation that I hadn't anticipated: a customs agent demanding proof that I bought my rig in the U.S. After some discussion I promised to register it for future trips, so she let me go without paying duty this time. I thought it would be enough that I could show by my passport that it had entered and left Belize. U.S. customs officials do not care what information another country enters into your passport, so register your equipment before you leave the States.

When I arrived home the mailbox was already full with QSL cards. The mailman probably thought I had started a mail order business.

After an exciting vacation and DXpedition like this, I can sure understand how most hams who have tried one trip can't wait to do it again. This information should get you started on your first trip. On my next trip, I would like to enter a contest and try for DXCC in a weekend. RF

Contact Stephen Werner KE4BM at 607 Springwood Circle, Huntsville AL 35803.

Photo C. Sunrise view from the hamshack.

supplies

TS-430S	Logbooks
OLV-15 power supply	License
MC-43S microphone	Code key
SWR meter	Headphones
50 feet RG-8X	Soldering iron
10 meter dipole	AC extension cord
15/20 meter dipole	Fishing line—ball
Spare fuses	Tape
Screwdriver	Eyelet Screws
Cutters	Pens
Knife	Clock
Ohmmeter	Tape measure

try something new

by Bill Brown WB8ELK

Line-of-Sight

When operating on the VHF or UHF bands, you'll soon hear the phrase "line-of-sight." What this means is that for the best reception (under average band conditions) you need to be able to "see" the other station's antenna. Anything beyond this range will require much higher power and large antenna gain to hear the weak signals from a distant station. The higher your antenna or ground elevation compared to the average terrain, the further you'll be able to communicate.

Let's say your 2m antenna is on top of a 100-foot tower in the flatlands. Just how far is your radio horizon from the top of your tower? You can use the following simple formula to determine the line-of-sight range from your station: $R = 1.41 * \sqrt{H}$, where R = range in miles and H = antenna height above average terrain in feet. Plugging this into the formula, you'll find that your line-of-sight range is $1.41 * \sqrt{100}$, which equals 14.1 miles. Due to refraction, radio waves will travel farther than your visual horizon.

Suppose you have a friend who lives in a town about 20 miles away and his antenna is 55 feet high. Can you talk to each other reliably on 2 meters without using a repeater? Plugging 55 feet into the formula tells you that your friend can see 10 miles from his station. Add this to your range of 14 miles and you'll find that your two stations can be up to 24 miles apart for best results. To make it easier to calculate your range, just use the small BASIC program shown in the sidebar.

Sure, you can talk farther than 24 miles, but you'll need large antennas and power to brute force your way through. Even powerful stations will have difficulty communicating beyond 60 to 100 miles under normal conditions. Beyond this, you'll have to depend on temperature inversions, ducting and various weather conditions to help extend your range. Sometimes these conditions (although fairly rare) can allow contacts over several hundred miles (in rare cases thousands of miles) away using modest equipment on VHF or UHF.

BASIC Program for Line-of-Sight Calculations

```
10 REM ** Line-of-Sight Range **
20 CLS
30 PRINT "Enter your Antenna Height or Altitude in Feet"
40 INPUT H
50 R = 1.41*SQR(H)
55 PRINT " "
60 PRINT "Line-of-Sight Range = ";:PRINT
INT(R);:PRINT " Miles"
70 PRINT " "
80 GOTO 30
```

Go Climb a Mountain

Fortunately, there is a way to dramatically increase your range without building a monster tower in your back yard. If you live near hills or mountains, you can take advantage of these natural antenna "towers." The line-of-sight range on top of a 5,000-foot mountain (above average terrain) is about 100 miles (even with your HT)! As long as obstructions are minimal between locations, you might arrange to talk to a friend on another mountain top over some pretty amazing distances. During a VHF/UHF contest I drove up to a 5,000-foot overlook near Yosemite National Park while Rod WB9KMO set up on 9,000-foot Mt. Pinos over 200 miles away. Since my radio horizon was over 100 miles and Rod's was about 133 miles, we were definitely line-of-sight to each other. I could hear him on 2 meters even with the antenna unplugged from my rig. We even worked each other on ATV (amateur television) with a perfectly snow-free picture with just a few watts of power. However, there is a catch to this. If there had been any intervening mountain peaks, they might have been in the way of our path. Fortunately, we were shooting across the central valley of California.

The Flatlands

Those of you who live in the flatlands shouldn't despair. You'll just have to create your own mountains. An expedition up to the highest building in town could be a lot of fun. For a real adventure, you might convince a friend with a pilot's license to give you a ride and really extend your range. You could work over 150 miles away with an HT at 12,000 feet! Jim WA8VWY used to commute in his Cessna 182 between Canton, Ohio, and Illinois every weekend. He had a packet radio station on board that allowed him to talk to stations in a several-state area as he flew along at 12,500 feet. Ground stations could even use his airplane packet station as a digipeater and communicate with other stations over 300 miles away.

Height vs. Range

(Feet)	(Miles)
6	3
50	9
100	14
1,000	44
2,000	63
5,000	99
10,000	141
20,000	199
50,000	315
100,000	445
1,000,000	1,410

The Sky's the Limit

Occasionally you'll hear a pilot on board a commercial jetliner with an HT. At a cruising altitude of 35,000 to 40,000 feet you'll be able to communicate with the pilot out to over 260 miles. A number of groups have taken this a bit further and launched helium-filled weather balloons carrying radio packages up to over 100,000 feet. Even though some of these packages only transmitted 100 milliwatts of power on 2 meter FM, ground stations over 400 miles away could easily copy the signal. During the SAREX experiments the astronauts in the space shuttle use an HT with an antenna mounted in the window. At their orbital heights of a couple of hundred miles, they could communicate over a 1,400-mile plus range (see the table for a chart of altitude vs. radio range).

Stir Up the Band

OK, so you don't own a jetliner or spacecraft. There are some times during the year when you are almost guaranteed some mountain-top DX contacts. The second weekend in June and the second weekend in September mark the ARRL VHF/UHF QSO party. Just about any mountain, hill or bump in the ground will have stations operating on it during these times.

If you plan your own expedition, be sure to let your club and other surrounding groups know about your activity. It may be a good idea to announce it over the packet BBS network as well. If you get the word out, you may be surprised at just how many contacts you can make. You'll have a lot of fun and will definitely expand your radio horizon. RF

the tech side

by Michael Jay Geier KB1UM

Basic Repairs

Now that you have a lab set up and have tried some soldering, you're ready to start fixing things. Well, almost. Repairing complex electronic devices requires some understanding of how their circuitry works.

By the way, the level of that understanding really has no limit. No matter how much you learn, there's always more, because technology keeps changing. Who would have thought 10 years ago that we'd have digital audio discs played by lasers and high-speed microprocessors, and that they'd be $150??

Our Domain

Ham radio equipment has been part of the digital revolution, too. Ever look at the schematic for an old tube transceiver? They used to call them "gutless wonders," and for good reason. There just wasn't that much inside. These days, though, the schematic for a full-sized HF rig requires many pages, sometimes even a whole book! Who could fix such a thing?

You can. Plenty of us do it all the time. There's a big "trick" to repair work, and I'm going to tell you what it is right now.

Finding What Works

Yup, that's it. The more you find that works, the more you can eliminate things that can't be causing the problem. You just keep doing that until you've narrowed it down to a small set of possibilities. When you get really good at it, you often can be reasonably sure of the problem before you ever crack the cabinet open! Let's take a look at a typical case:

Your trusty radio suddenly refuses to receive any audio. No matter what band you tune to, you hear nothing. Is your poor radio dead? Well, do the lights light up? If not, go straight to the power supply. No radio is more than a paperweight without power. If it does light up, then you know it is getting power and that its internal power supply circuitry (if it has any) is working.

Next, turn the volume all the way up and listen to the speaker as closely as you can. Put your ear right up to it. Is there any hiss at all, any sign of life? If so, the audio amplifier is probably OK, the earphone jack is passing the signal to the speaker, and the speaker itself isn't blown. No hiss? Well, you've just found a vital clue. Start looking at the speaker itself, the earphone jack, and the audio amp circuitry. (In future articles, we'll explore the troubleshooting of every stage of a radio. Don't worry right now if you don't know how to check amps and speakers.)

See? By finding what works, we have eliminated most of the radio's stages as potential troublemakers and saved countless hours of searching through working circuits.

Many times such a rig is sent to a repair center with the complaint that it is "dead." Well, it could be, of course, but often it isn't even close to death. In fact, it may have very little wrong with it. "Dead" is the catch-all description many people use for every malfunction, even when there are clear indications that parts of the radio are working. A rig is dead only if *nothing* at all happens when you turn it on.

Your First K.I.S.S.

Serious, complicated things can go wrong with your gear. But in the *vast majority* of cases, the problem will turn out to be very simple. The easiest way to burn many hours of time, and perhaps to damage the rig even worse, is to start looking for complex problems before eliminating *all* of the obvious ones. In other words, use the KISS method (Keep It Simple, Stupid!). Every technician alive has had a few instances where he or she went around in circles for days, only to find an obvious answer which had stared him in the face all along!

I can think of a few which will haunt me as long as I live. It will happen to you, I promise. When it does, though, learn from it so it won't happen again under the same circumstances. A hint: Any puzzle which won't fit together probably has a piece missing! If your diagnosis doesn't add up, you're missing something. Keep looking.

Measuring Up

It's time to start using that nice VOM or DVM you just bought. As we discussed earlier, taking measurements is vital to most repairs, because it's the only way you have of "seeing" electronic activity. Let's examine each of your available measurements and try each one out to get the hang of doing it.

Voltage: This is probably the one you'll do the most often. Voltage refers to the amount of energy each electron is carrying. It's kind of like the pressure in a hose. The higher the voltage, the more work a given volume of electrons can do. The interesting thing about voltage is that it is strictly relative. In other words, a voltage exists only in relation to another voltage! So, a given point in a circuit can be at +9 volts with respect to circuit ground (a concept we'll discuss later on), yet be at only +5 volts with respect to another point +4 volts above ground. It gets even weirder: the same point can even be negative, relative to a reference point which is at more than +9 volts! Again, it's all relative.

To make voltage measurements, set your meter to a range just a bit higher than the voltage you intend to measure. Of course, if you're using an autoranging DVM (digital voltmeter), you don't need to worry about it, because it will find the range for you.

I'm assuming that you are measuring DC voltages. Nearly all of the circuits you encounter will operate on DC. The major exception is the power supply, because it has to take AC in and make the DC for the rest of the rig! The black lead should be connected to the reference point. Usually, this point will be "ground," which is the common point from which everything else originates. Try the metal chassis, because most grounds are tied to it.

The red lead goes to the point you wish to measure. If the measurement point is positive (+) with respect to ground, it will move the meter needle up on an analog meter and will read a number on a DVM. If the analog needle goes backwards, or there is a minus (-) sign next to the DVM readout, then the point you are measuring is negative with respect to ground. On the DVM, you can just read out the value, but on the VOM (volt-ohm-meter) you must reverse the red and black leads to take a reading. By the way, never let the meter sit for long with its needle slammed against either end of its range, or it may become mechanically damaged. If it slams all the way up, you need to go to higher range.

Try this out with a small battery, such as a 9-volt or an AA cell. Try reversing the leads and seeing what happens. Be careful not to short the two leads together while they are connected to the battery.

A word of warning: The insides of electronic devices are not foolproofed the way the outsides are. You can get hurt if you are not careful. Even battery-operated devices (especially TVs and transmitters) can have circuits which step up their initially small voltages enough to kill you. Taking voltage readings requires that the circuit you're reading be energized, so take care to avoid contact with the power.

If a circuit involves more than about 30 volts, keep one hand in your pocket to avoid any current passing through your chest, where it is the most dangerous. In any event, always keep your hands off the ground connection while taking measurements. It's best to use a clip lead.

Ohm My!

Resistance: Taking resistance readings is quite a bit different. For one thing, the object you're reading (usually a resistor, but not always) must have no power applied to it. (So where does the power to move the needle come from? From the battery inside the meter!)

Disconnect the power from the rig. Now, take a voltage measurement (with respect to ground) on each side of the resistor. If it shows more than a few volts, let it drain off before proceeding. In many circuits, you can short each side to ground to discharge whatever capacitor is supplying power to it, but it is possible to damage some delicate circuits that way, so don't do it unless you're sure of yourself.

In some cases, you can measure resistance without removing the part from the circuit, but in other cases, things connected to the part you want to measure will interfere with the reading. To be sure, disconnect one side (or "leg") of the part.

Now, set your meter to the appropriate range. DVMs need no calibration but, if you're using a VOM, you must short its two leads together and adjust the "zero adjust" knob until the needle sits at the zero ohms point. Usually, you have to do it again any time you change ranges, too.

Unless you're measuring the resistance of a semiconductor, the polarity of the leads makes no difference, so just hook one on each side of the resistor and read its value on the meter. If you've set it to too low a range, a DVM will display an "overrange" indicator, typically a flashing "1." A VOM will simply show little or no indication. In either case, try a higher range.

Try this out on a few of the resistors in your assortment. The readings should be fairly close to the resistors' true values. Don't worry if they are off a little bit; that's normal.

Keeping Current

Current: Current describes the number of electrons that are flowing. It's just like the amount of water in a hose. In order to measure the flow, you need to have it flow through your measuring instrument! For this reason, you have to disconnect one end of the circuit and connect your meter between the two points. Connect the red lead to the most positive point and the black lead to the other one. So, if you're measuring the current being drawn by a circuit from its power supply (a useful and common measurement), the red lead would go to the power supply side, assuming it is a positive supply. If it's a negative one, the black lead would go there.

Be sure to set your meter to its highest current range before you turn the power on! More meters are damaged through current measurement than by any other means. If you have any reason to believe that more current will flow than your meter can handle, don't make the measurement. Now, turn the power on, being sure to follow all the precautions discussed under the section on voltage measurement. If the meter needle swings backwards, shut everything off and reverse the leads. If the reading is very low, reduce the range setting until it is readable. When you're done, shut it all down and reconnect the broken circuit.

By the way, *never* connect a current meter directly across a source of power. Without some resistance in series with it, the meter will attempt to measure all the current the power source can deliver, and you will probably cause some damage, at least to the meter and possibly to the power source as well!

Try measuring the current through some of the resistors in your assortment, using a battery for power. Measure the battery's voltage and the resistor's value first, and then see if your current measurement agrees with Ohm's law. I bet it will!

Well, we're out of space for this month, so we'll continue this and discuss "ground" next time. 73 from KB1UM. RF

You may contact Michael Geier KB1UM in care of 73 Magazine, *Forest Rd., Hancock NH 03449.*

letters

Continued from page 5

General, get a beam for SSB, etc.). Many hams talk about how they have to get me upgraded. Everyone talks about how easy code is . . . but it takes time to learn. Right now I just want to get on 6 and 2 meters, and have my first QSO.

I find myself pouring over ham equipment catalogs, jotting down specs, etc. I enjoy this anticipation mode as much as anything. No code will surely be good for the radio industry as a whole—I know that soon I will be dropping an armload of cash (well, plastic to start).

When I get the time, I want to see how far I can talk. Yes, DX on VHF and UHF. Yup, I wanna look into packet and amateur TV someday.

Ray Grandahl KB8MRF, DePere WI I am a new ham of four months. I took my Novice exam just before the no-code Tech rule came into effect. You are right-on about CW these days. I am only 10-meter capable right now, but even so, I sure do not hear much CW on 10 meters.

If the old-timers who are complaining about the new rule would come down to the Novice portions of any band and answer our CQ calls, have a QSO with us, and give us some practice and helpful hints, maybe the CW portions would be used a lot more. As it is, the old-timers who are complaining are not even using the code themselves. Well, I say that if no one is using the code anymore, get rid of it.

Speaking of things not being used, we lost 220 MHz, and we will likely lose more. Why? Because no one uses them. Eventually I will be licensed for these other bands; I sure would like them to be around when I get there. You want new hams? Give them the opportunity—no code. You want new hams? Keep the bands for them. Why should they get into something that isn't there anymore? When I can afford the equipment, I will be there.

Speaking of being able to afford things, I have to tell you that I am one operator who has a very low budget to operate on. I operated my 10 meter rig on a 12-volt car battery for 3 1/2 months before I could afford to purchase a 10-amp power supply for $75. I am sure there are many hams out there in the same situation. When you talk about the hams who don't want to experiment with packet, RTTY, SSTV, OSCAR, ATV, and moon-bouncing, I need to tell you that there are many interested hams out here who want to, but who can't even afford a low cost PC to get started.

Ray, suppose 10 or 15 hams within driving distance in your area get together and start a club? Ten dollars times 10 hams is $100. At $10 per month dues, that's $1,000 in 10 months for club equipment. But before you buy equipment with others, be sure you are all clear on operating agreements, such as where the equipment will be located, what happens if a member moves away (does he get a refund for his contribution?), etc. Plan for all the contingencies you can think of. . . . Linda KA1UKM

RF review

The SupeRX HF Receiver Kit

Easy-to-build kit with big-rig performance.

by Bill Brown WB8ELK

MXM Industries
Rt. 1, Box 156-C
Smithville TX 78957
(512) 237–3906

Price:
SupeRX—$49.95 + $4 shipping
Optional tuning capacitor—$10
(while supply lasts)

Originally appearing in the April '91 issue of *73 Amateur Radio Today*, the SupeRX kit allows you to build up a miniature single-band receiver that fits in the palm of your hand. Through the use of just four 8-pin ICs and a handful of components, this simple design is extremely easy to assemble.

Designed by Bruce Williams WA6IVC of MXM Industries, this little marvel uses a superhet (double-conversion) design to give you the ultimate in performance in a very compact package. The superhet scheme involves converting the receive frequency down to an intermediate frequency (455 kHz in this case), and then downconverting again to the audio range. Through the use of a small 455 kHz ceramic filter, the selectivity (ability to eliminate adjacent frequency signals) is excellent. This same double-conversion design is used in most large receivers.

Assembly

The kit comes with all components, an etched and drilled PC board, and an optional tuning capacitor (with built-in vernier drive) and dial. I found the assembly instructions easy to follow with each step thoroughly explained. Due to the low number of parts, this should be an evening project for most people, regardless of their kit-building experience.

One of the nicest touches was the use of commercially available coils and transformers. I always hate winding coils, and Bruce's use of these coils eliminates a lot of hassle.

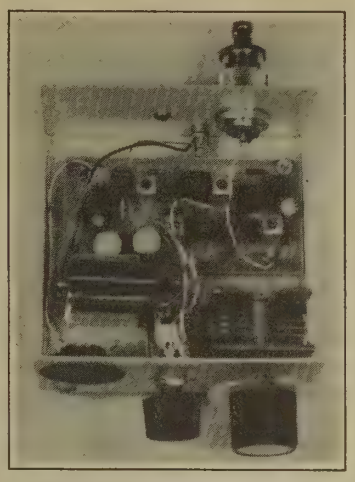

Photo A. The completed SupeRX receiver can be mounted in a very small enclosure (case not included).

After assembling the main circuit board, all you need to do is wire up the power leads, a small speaker (or headphones), the antenna jack, volume control and the tuning capacitor. A case is not included with the kit, but several appropriate enclosures are available through mail-order houses or Radio Shack.

Tune-up

You don't need any special test equipment to align the receiver. There are only four adjustments to tune up the receiver to top performance. Although it's easiest to use a frequency counter or oscilloscope to get you close, you can just use a ham band (or general coverage) receiver and listen for the local oscillator signals.

For example, let's say you want to adjust the SupeRX for operation on the 40m band with the low end of your tuning range located at 7.000 MHz. Since the SupeRX uses a 455 kHz intermediate frequency, the local oscillator operates at 455 kHz above or below the actual operating frequency. Just place the SupeRX near your communications receiver and listen for the local oscillator signal at 6.545 or 7.455 MHz while adjusting the appropriate transformer. In a similar manner you can use an AM broadcast receiver or your communications receiver to adjust the product detector for 455 kHz.

Once these two adjustments are set, you just attach an antenna to the SupeRX and tweak the last two transformers for maximum signal while tuning through the band. A couple of fine adjustments and you're ready to tune into the action. It really doesn't take very long to make these four adjustments.

Operating with the SupeRX

How's it work? Fantastic! I compared the SupeRX with my $1000 big rig on the crowded 40 meter band during the night. This is a tough test for any receiver with all of the foreign broadcast stations that pound in on the upper end of the band. I could hear everything that my big rig was pulling just as well on the SupeRX. I could detect no perceptable drift in this receiver, even when I first turned it on. The SupeRX uses a Hartley oscillator design which, combined with high-quality Silver Mica capacitors, produces a very stable local oscillator. With the optional variable tuning capacitor, I found I could easily roam the band at just the right tuning speed. Not only did it do a great job on CW reception, it also worked just fine on SSB voice signals. In fact, I could hear tons of European stations coming in just below 7.080 MHz. You can even tune in the foreign AM broadcast stations by zero-beating on their center carrier frequency. I recommend that you use a vernier-control tuning capacitor for the easiest tuning. MXM Industries has a limited supply of vernier tuning capacitors that are available as an option. If you can't find an appropriate capacitor, you can use two capacitors such that one functions as a coarse tune (large capacitance range) and the other works as a fine tuning adjustment (small capacitance range).

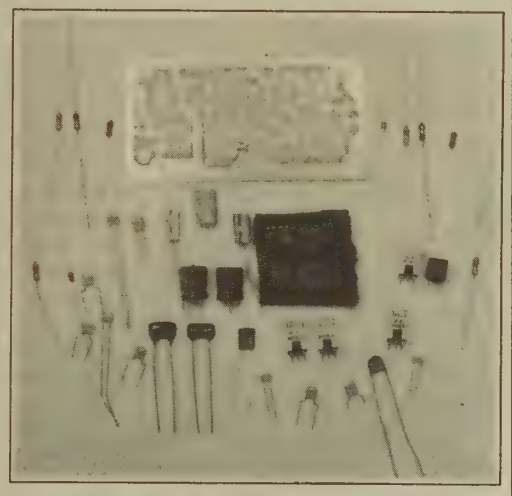

Photo B. The SupeRX receiver kit.

You do need a resonant antenna for maximum results. Don't expect to hear much of anything with a coat hanger (or clip lead) antenna! At times, a really strong signal will appear distorted because of overload. This is easily fixed by lowering the volume control until the signal sounds normal.

Impressions

I'm really quite amazed at just how well this kit works. Not only did it work the first time, it receives just about as well as my big $1000 transceiver. All this in a package that fits in the palm of your hand and runs for several hours on a 9-volt battery.

The SupeRX combined with a small transmitter would make an ideal portable QRP station that would work equally well on a camping trip or at home in your hamshack. RF

RF book review

Mini Book Reviews for Hams & Hobbyists

by George M. Ewing WA8WTE

The Beginner's Handbook of Amateur Radio, 2nd Ed., by Clay Laster W5ZPV. (1988) TAB Books. ISBN 0-8306-2965-3. 424 p., $18.95.

Overall, this is a good, inexpensive beginner's handbook, aimed at getting a reader started toward a Novice or Technician license, or as a general introduction for the interested lay person. The book is a compact 8-1/2" x 5-1/4" paperback, and more convenient for a student to carry around than full-size handbooks; it's just slightly bigger than a VHS video cassette. The theory sections are clear and straightforward, with FCC-type sample questions, and there are a number of easy beginner's construction projects, including a simple audio amplifier, a crystal frequency standard, a 100 milliwatt QRP transmitter, a code practice oscillator, antennas, etc.

However, this book was last revised in 1987, so it doesn't include the latest details on the fast-breaking areas of license requirements and new band privileges. Also, I would like to have seen at least one good build-it-yourself receiver project. There is a nice little direct-conversion 40 meter receiver on page 298, for example, but it is given as a block diagram only, with no construction details or schematic.

There is also a little extraneous padding in the text, along with all the useful data. For example, most of page 48 is occupied by photographs of code practice cassettes. Everybody knows what an audio cassette looks like; the editors could have omitted several items like this, and used the space saved to include thorough details for at least one practical receiver that can copy CW as well as phone signals. Overall, though, it's a useful book.

Sams Radio Handbook, Twenty-Third Edition by William I. Orr W6SAI. (1987) Howard Sams & Co. ISBN 0-672-22424-0. Approx. 650 p., $39.95.

This excellent but relatively expensive handbook is the most recent in a long line of editions that date back to the original handbook published by *Radio* magazine in the 1930s. It has been a best seller over the years and a competitor for the *ARRL Handbook*, so comparisons are probably inevitable.

This handbook really stands out in three areas: a) math and electronic theory, b) antenna design and construction, and c) high-power linear amplifier design and fabrication, both for the low bands and for VHF/UHF.

The theoretical background presented in this book is right up to professional engineering standards, with page after page of tables, nomographs, filter parameters, Smith charts, and design equations. An experienced ham could design almost any amateur equipment from scratch, given the data and guidelines included here. However, a beginner may find portions of this a little overwhelming.

The editors have apparently decided that amateurs just won't or can't build transmitting equipment anymore, so while there are many different high-powered amplifiers described in loving detail, plus a couple of good receivers, there's a shortage of medium- and low-power gear for beginners, QRP enthusiasts, and VHF hamming.

I hesitate to perpetuate the jokes about "California Kilowatts," but one of the designs W6SAI has in here, the 4 kW linear in Chapter 17, has no legal place on the ham bands at all, though it might be a useful model for a shortwave broadcast engineer or commercial marine technician. Likewise, a 600 watt linear for 920 MHz won't be much use to a beginning ham, whereas a 100 watt transmitter for the Novice bands or a 5–25 watt FM rig for packet and VHF operating would be much more useful.

I have one other minor gripe about this otherwise excellent book. There are lots of photographs used to illustrate the construction projects, and while perhaps two-thirds of them are faultless, a handful of them, especially inside views of receiver chassis, etc., are way too dark and "contrasty," to the point that important construction details are lost to the reader. This may be the fault of the book printer rather than of the editor and darkroom staff, however.

The Packet Radio Handbook, 2nd. Edition, by Johnathan L. Mayo KR3T. (1989) TAB/McGraw-Hill. ISBN 0-8306-3222-0. 228 p., $16.95.

This is a good beginner's introduction to the fascinating world of packet communications. It assumes that the reader already knows the basics of ham radio, but has practically no background in computers, rather than the other way around. A big improvement from the earlier edition: A lot of blurry, hard-to-read computer screen photographs in the 1987 book have been replaced in this edition with a nice, clean, typeface that is a lot easier to read.

The packet scene is changing very fast, and a book published today will probably have some obsolete sections in a few months, let alone years, but this will get a reader started on the basics.

The Complete Shortwave Listener's Handbook, 3rd Edition, by Hank Bennett W2PNA, Harry L. Helms, and David T. Hardy. (1986) TAB/McGraw-Hill. ISBN 0-8306-2655-7. 294 p., $17.95.

In the old days, a vast majority of beginning hams got started by listening on the shortwave broadcast bands and building receivers like the old Knight-kit "Ocean Hopper" or Heathkit equivalents, and spent a lot of time listening to Radio Moscow and the BBC, the commercial traffic stations, and a lot more, in addition to tuning the ham bands for fun and code practice. Many of today's new hams get into the hobby through other channels, such as the military, CB radio, or hobby computing, and aren't always aware of all the neat stuff that's out there on the HF bands (as well as VHF scanner channels) or the fun that can be had by logging rare and exotic DX broadcasts, collecting SWL QSL cards and awards, and all the rest.

When W2PNA first brought out this book in 1974, it was a bonanza for SWLs and hams who had been gleaning bits and pieces of information from obscure magazine and newsletter articles for years, and now had most of the basics all in one handy volume. This is the third edition, and is highly recommended.

Radio Operator's License Q&A Manual, Eleventh Edition, by Milton Kaufman. (1991) Hayden Books. ISBN 0-672-48444-7. 553 p., $24.95.

This book is a study guide for the Commercial (not amateur) Radiotelephone license. The requirements for the various commercial FCC licenses are changing fast, too, and may be greatly relaxed with deregulation. However, the technical material on electronics, semiconductors, signal propagation, and basic radio theory in this volume is very useful, and roughly comparable to a lot of the questions on the General and Advanced class ham license tests. Taking some of these questions for practice is an excellent confidence-builder. There are also sections here on things like shipboard radar procedures and FAA aeronautical radio regulations that won't be of all that much immediate use, so you'll have to pick and choose.

Build Your Own IBM Compatible and Save a Bundle (et. al.) by Aubrey Pilgrim. (1988) Tab Books. ISBN 0-8306-2831-2. 208 p., $14.95.

After the Commodore 64, the IBM PC compatibles are probably the most commonly found personal computers in the modern hamshack. There is more cheap and free software available for the PCs, for everything from logging QSLs for a contest to tracking an AMSAT satellite, than for any other computer. Aubrey Pilgrim's do-it-yourself books allow a beginner with a very modest technical background to plug together mail order and surplus components to build a PC compatible a lot cheaper than a "store-bought" PC.

The 1987 edition is the first in the series, which now has grown to include the 80286 "AT" compatible machines, (1988, ISBN 0-8306-3031), 80386 machines (1988, ISBN 0-8306-3131-3) and most recently, the gosh-wow 80486 (*Build Your Own 80486 PC And Save a Bundle*. (1991) Windcrest/McGraw-Hill. ISBN 0-8306-7628-7. 220 p., $16.95.).

The earlier editions will be especially useful for a ham who is think-

ing of buying an earlier model PC used or surplus at a hamfest swap-shop, one which may not have all the factory documentation, or for someone who already has a PC or XT compatible and wants to upgrade it with a new or surplus hard disk, display card, etc.

Electronic Projects for your Commodore 64 and 128 by John Iovine. (1989) Tab Books. ISBN 0-8306-9383-1. 179 p., $15.95. (companion disk available for $24.95 plus $1.50 S&H).

Despite a couple of drawbacks, most notably a very slow disk drive on the early models, the Commodore C-64 and its slightly more advanced cousin, the C-128, are among the most popular personal computers for the ham or other electronic hobbyist. The compact layout and ability to use any junk TV set for a monitor make these machines especially popular for ham packet setups, household security systems, and many other applications.

This book provides a straightforward primer on interfacing electronic devices to the C-64 and C-128 user port, and a number of cookbook projects for the user who is also an electronics hobbyist. All of these projects use relatively inexpensive off-the-shelf hardware available from Radio Shack or mail order houses, and include A-to-D conversion for various sensors, a $25 speech synthesizer, a digital audio oscilloscope, appliance controllers, a sound digitizer, a frequency counter good up into the 600 kHz range, and most impressive of all, a rudimentary digital slow-scan camera using a cheap Edmund Scientific surplus lens and a modified DRAM chip as a 8,192 pixel photosensor! (The pictures from this last are pretty crude, probably not adequate for serious on-the-air ham slow-scan operation, but okay for simple demonstrations such as a slide of your call for a QSL, etc.)

Almost all of the software for the projects is in BASIC, or in short machine language routines with a BASIC loader, and the programs are available on disk. There's lots of good techie entertainment and learning to be had here for class and science fair projects, or just-for-fun experimenting. RF

Taylor Montgomery admires his dad, Jeff, talking on 2 meters. Maybe he will grow up to be as avid about amateur radio as his dad. Jeff WB4WXD is an Extra class radio operator living in Palestine, Texas. He got interested in radio in college, and has been delving deeper and deeper since then. He has been present at many an "antenna raising," taught Novice classes, is a VE (Volunteer Examiner), and has been involved in several emergency operations, including a devastating tornado in Palestine in 1987, when he didn't come home for three days. He is ready to talk "ham" with anyone and help out as much as possible. He even talked his reluctant wife, Cindy, into obtaining her Tech license in 1988. Jeff is ready, willing, and able to help anyone interested in upgrading or becoming a ham.

radio magic

Continued from page 20

Turn the main dial. Is it smooth? Can you notice any backlash (the dial turns backwards by itself). Is the tuning real mushy? Try the other controls for the same feel. All should operate smoothly. Try to operate the switches. Is the pointer in the meter? Are all the knobs factory or did Radio Shack supply them? Look for extra switches, knobs, holes, etc. If there are extra switches and the like, there is a good chance that this radio has been modified. Look at the back panel. Extra holes about? Has the ground connection been used? Check the antenna connector for wear. Wear on the connector can mean the radio has been moved a lot, has seen several owners, or could be a repair problem (the radio is always in the shop).

Flip the radio over and check for messed up screw heads on the screws that hold the cabinet together. This will reveal that someone has been in the radio and may have opened the case with a scout knife. The top of the Yaesu will pop open. Open the top and take a good look inside. Notice the factory sealed slugs, cans and VFO. If any of these seals are broken, the price of the radio will have to reflect the fact that someone was inside where they were not supposed to be.

While you're inside, look for dust, dirt, rust, and what have you. If the owner kept the radio in good shape, there will be little dust and NO rust. Also, check for any additional circuit boards that are not from the factory.

After you have given the radio a very good looking over, now is the time to talk to the owner. Ask him why he is selling the radio. Is the radio his? Has it ever been messed with (broken seals)? Has the radio been placed on the CB band? The Yaesu FT-101E will cover the band, don't you know? Did he have much trouble with the radio? Was it hit (OH NO!) by lightning? Ask all the questions now; after you walk away it will be too late.

If the man behind the table is not the owner, then where is he so you can talk to him? My favorite answer of all time to this question is, "Well, the guy who owns this radio is a friend of a friend of my second cousin. He is in Michigan this week, getting a divorce from his third wife. He does not want his wife to know that he is selling all his gear so she won't be able to get the money." Buy his radio? Not on a bet!

Don't reach quite yet for your money. Does the seller have the manuals? This is very important. Get the manuals. Try not to let him "send them to you." Get HIS name and address. In case he forgets, you can remind him.

Be sure that the power supply goes with the radio—all for one amount of money. You don't have to worry about the Yaesu, but a lot of the newer, solid- state radios require a separate 12 volt power supply.

If you're happy with what you have seen and heard, then start talking price. Remember, he will have an inflated price, and he knows he will have to drop some, so start out low and see if you both can meet in the middle.

One way to get the price lower is to pick out something that you may have noticed on the radio, such as a gouge in the side panel. Tell him, "I'm not going to pay full price with THAT on the side of the radio. What happened, anyway, did you drop it?"

What does a Yaesu FT-101E go for? Well, plan to spend anywhere from $175 (bad shape) to $350 for a mint radio. Perhaps even more if extra filters, crystal or Fox Tango, have been installed.

Beginning Operation

Now you're the proud owner of a used Yaesu FT-101E. Try to resist the temptation to just plug it in and have at it. Read the manual first. Take the case completely off the radio. Look for signs of trouble BEFORE you apply juice to the circuits. Open the PA compartment. Look things over very closely. Look for broken high voltage insulators. Check the tubes for broken seals.

If the radio was just removed from service from the previous owner, go ahead and plug it in. If the radio has been sitting in a dark corner of someone's basement, that's not the best thing to do. The reason? The filter capacitors are not formed, and they will look like a short circuit to the power supply diodes. That sudden jolt of juice can really be an eye-opener!

What you need is a variac transformer—an adjustable transformer. If you don't have one of those (and I don't, either), make up a special power cord. I use a couple of 110 volt light bulbs in series with the radio to reduce the surge at turn on. After 10 minutes or so, I remove the surge protector cord and connect 110 directly to the radio. RF

Michael Bryce WB8VGE may be contacted at 2225 Mayflower NW, Massillon OH 44646.

Radio Fun flea market

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar, and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *Radio Fun Flea Market* costs you peanuts (almost)—comes to 10 cents a word for individual (noncommercial) ads, and 70 cents a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple of months before the action starts; then be prepared. If you get too many calls, you priced it too low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right, and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested.

Send your ads and payment to *Radio Fun Flea Market*, Sue Colbert, Forest Road, Hancock NH 03449 and *get set for the phone calls.*

FOR SALE: Heathkit HW-99 CW transceiver, partially assembled. Best offer. Optoelectronics 2300 frequency counter, new, $90. KB5AYO, Rt. 1 Box 580-B, Reserve LA 70084. **RF231**

HOBBY/BROADCASTING/HAM/CB/SURVEILLANCE transmitters, amplifiers, cable TV, science, bugs, other great projects! Catalog, $1.00. PANAXIS, Box 130-R9, Paradise CA 95967. **RF232**

PICTURE QSL CARDS of your shack, etc., from your photo or black ink artwork. 500, $26.00; 1000, $40.50. Also non-picture cards. Custom printed cards, send specifications for estimate. Send 2 stamps for illustrated literature. Generous sample kit, $2.00, half pound of samples $3.00. Raum's, RD 2, Orchard Road, Coopersburg PA 18036. Phone (215) 679–7238. **RF260**

JUST IMAGINE YOUR OWN BLUE RIDGE MOUNTAIN TOP 25-acre QTH in the cool, green mountains, only $975 per acre. Wonderful view, wild game, privacy, road frontage, small stream, ideal for hamming, retirement or summer home. Financing available. KK4WW, Floyd VA. (703) 763–3311. **RF262**

PREMIUM QSL CARDS Unique colorful designs, starting at $75 for 250. Send $1.00 for catalog and samples. BVE Professional Printing, 2023 Chicago Avenue, Suite B13-3, Riverside CA 92507. Tel. (714) 781–0252. **RF264**

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RF1191

vintage RF review

The Icom IC-2AT Synthesized Talkie

by Dave Ingram K4TWJ

Miniaturization techniques and frequency synthesizers are creating some radical and exciting innovations in the world of 2 meter hand-held transceivers. Large, crystal-controlled handies capable of operation on five or six discrete channels are giving way to pocket-sized equivalents capable of 800-channel operation, two-tone encoding and much more. The mass clamor for these palm-sized gems and their accessories is extensive, with almost every active amateur wanting to get in on the action. The capability of carrying a full communications system comfortably in one hand has a distinct advantage which is, indeed, hard to beat.

In addition to their everyday use through one's local repeaters, frequency-synthesized handies are particularly useful when traveling via airlines and rental cars. (I don't advocate using the HT aboard a commercial airline, but its emergency capability is reassuring.) Once clear of airport hassles, the HT can be set on an area repeater and placed on the rental car's seat. This pleasure is proving its worth to HT owners every day.

Hand-held talkies also make ideal mobile rigs when used with a 25- or 50-watt amplifier and a gain antenna mounted on the auto's roof. When leaving the auto, the handie can be carried right along and used portable.

During recent years, I've used almost every hand-held transceiver on the market. Every unit was an exceptional performer, each exhibiting some special feature or features unique to that manufacturer. Recently, however, I secured what seems the most enjoyable and logical talkie I've ever owned—a new Icom IC-2AT.

The Rig

Two models of the Icom handie are available in the US: the IC-2A and the IC-2AT. The difference between these units is that the IC-2AT includes a touchtone encoder which is molded into its front case. The encoder adds only 1/16" to the case thickness, its inner area is rubberized, and the buttons have a positive snap action. The rubberized area is slightly recessed to provide some protection from pocket edges, etc.

There are two unique features in the Icom's encoder. When punching numbers, the tones can be heard on the handie's speaker. The loudness of these tones follows the handie's volume control setting. After punching a single digit and hearing those two tones in return, the handie's push-to-talk can be released. A VOX circuit in the unit holds the rig on transmit until approximately one second after the tones are completed. This delay will follow almost any dialing speed one cares to use. Next, the transmit LED atop the unit will extinguish and the handie will automatically return to receive mode.

The Icom handie is smaller and lighter than other handhelds, and it can actually be slipped into pockets where other units won't fit. In fact, the Icom can be comfortably carried in the vest pocket of a suit coat all day without evidencing itself by a bulge.

Frequency selection with the Icom handie is done with small thumbwheel switches mounted atop the unit. Two main advantages of this arrangement are the ability to change frequencies by merely feeling and counting steps rather than by looking at the rig (very beneficial when mobiling in rush-hour traffic) and the fact that this mechanical memory doesn't require battery current or reprogramming during periods of minimal use. An LED mounted beside the thumbwheel switch/frequency display indicates transmit mode and battery condition. Three small switches are submounted on the Icom's back for selecting high/low power, simplex or duplex operation, and +600 or -600 kHz transmitter offset. Odd splits and 1 MHz splits are not provided in the Icom. A belt clip is also furnished with the Icom; it can be used or removed, as desired.

Internally, the Icom handie consists of layered PC boards which open book-style for servicing. The receiver is double conversion with a first IF on 10.695 MHz and a second on 455 kHz. Through actual on-the-air use, I've found sensitivity and selectivity comparable to other quality handies on the market. The transmitter uses a conventional and popular varicap/frequency multiplier arrangement to achieve a crisp, clean transmitted signal. A voltage regulator circuit applies +5 and +6 volts to all stages except the transmitter's driver and final amplifier. Those stages receive full battery voltage for producing maximum transmitted RF energy. The handie's LED monitors voltage to the regulator during transmit mode.

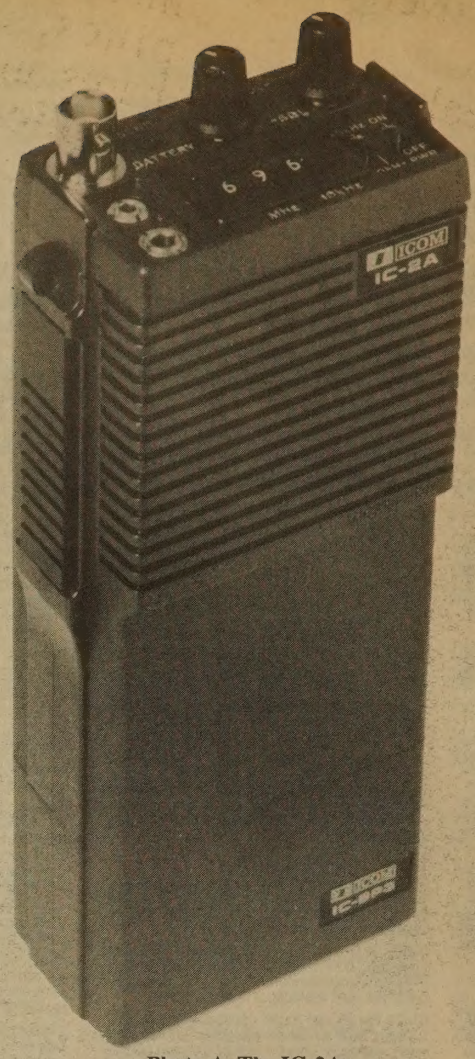

Photo A. The IC-2A.

Conditions	Total Current
Receiver on, squelched	12 mA
Receiver on, signal present, low volume	25 mA
Receiver on, signal present, high volume	35 mA
Transmitter on, low power	200 mA
Transmitter on, high power	400 mA

Table 1. Current drains measured on the IC-2AT. Battery voltage was 8.7 volts.

The Power Source

Power for the Icom handie is supplied by a slide-on battery pack on the unit's bottom section. Mating is accurate and positive, without "play" or loose edges. The standard battery pack supplied with the Icom is a 250 mAh unit of relatively small size. This pack is no slouch, however; it powers my unit to 2.4 watts output when normally charged. The output power drops from 1.3 watts when the batteries are almost depleted. (These measurements were conducted using a dummy load and a Bird wattmeter.) Battery life when using this 250 mAH pack depends on the amount of transmitting, receiving and squelched time employed. Obviously, this situation varies with individual applications. You can calculate HT use time for your particular type of activity with the aid of Table 1. If, for example, you listen for one hour (approximately 30 mA) and transmit for a total of three-and-a-half minutes (approximately 60 mA), a fully charged 250 mAH pack will be dropped to approximately 160 mAH. Speaking from a more non-technical standpoint, the Icom (with its 250 mAH pack) exhibits the same battery life as the Yaesu FT-207R. Several optional battery packs should soon be marketed for the Icom handie. The BP5 pack will contain nine 450 mAH NiCds and power the HT to an advertised 2.3 watt output.

Finally, the BP4 case looks particularly appealing and useful. This is a blank case which can be loaded with six alkalines or six NiCds of the 450 or 500 mAH variety. When this case is used in conjunction with the standard 250 mAH pack (BP3), continuous operation is possible by alternately swapping and charging packs. The slide on/off feature permits this option without missing a single QSO.

Personal Evaluation

I've personally found the Icom handie perfectly adaptable to my particular needs and pleasures. Its small size and light weight are, in my opinion, definitely a worthwhile trade-off for the scanning feature of my previous frequency-synthesized HT, and the slide on/off battery packs are an ideal means of keeping the unit operating continuously. The microphone is placed midway along the unit and opposite the antenna. This allows the unit to be canted back during use to prevent RF from radiating broadside into the eyes. Both transmit and receive audio are exceptionally crisp and clean. I think it's a great little transceiver and recommend it heartily. RF

This review is reprinted from the September 1980 issue of 73 Magazine.

weather nets

Continued from page 11

Common Sense

1. Carry spares: Have auxiliary power, an extra battery pack, a second antenna, rain gear, and something to protect your HT in case you have to leave the car.
2. Don't tell the control operator if you move a few blocks, but do check in if you move several miles.
3. Because hail can be the harbinger of worse weather, consider reporting any hail larger than a quarter of an inch in diameter—and always give measurements in inches. If other spotters are reporting hail that's substantially larger than what you're experiencing, stay off the air.
4. Report sustained heavy rain—rain that knocks leaves off trees, even without wind. "Sustained" means more than 15 seconds. Tell the net control operator how far you can see.
5. Report high winds (sustained 50 miles an hour or above), but if you're unsure of the wind speed, don't guess. Wind speed of 50 miles an hour will cause entire trees to move and will break some live branches.
6. Remember: Your primary audience is a Weather Service radar operator, but radio and television news departments, law enforcement agencies, schools, businesses, and the general public will all be listening. Say nothing you'd be uncomfortable uttering while standing in front of a classroom full of third graders.

A little study and advance planning go a long way when natural disasters strike. Not all parts of the country are threatened by tornadoes, but no part of the world is immune from disasters. Take the time now to become familiar with the information necessary to be a useful part of your area's severe weather net. RF

Contact William F. Blinn at 179 Caren Avenue, Worthington OH 43085.

weather nets

	Freq.	UTC	Days
Antilles Weather Net	03.815	0630	Daily
Buckaroo Net	07.264	1100	Mon–Fri
Caribbean WX Net	03.815	1030	Daily
Caribbean WX Net	03.815	2230	Daily
Central OH Weather Net	146.760	7:30 p.m. EST or EDT	Tues
European Weather Net	03.680	0500	Mon–Fri
Grandfather's Net	03.962	1330	Mon–Fri
Gulf Coast Hurricane Net	03.935	0100	Daily
Hurricane Watch Net	14.325		Daily
John's Weather Net	14.315	0220	Daily
New England Weather Net	03.965	1030	Mon–Sat
Weather FC Net	03.682	0500	Daily
West Gulf Hurricane Net	07.268	1800	Tues

These are just a few of the available weather nets. All of those listed above may not be operating at this time. There are many weather nets on 2m FM. Check with your local radio club for more information.

Sources: *ARRL Net Directory*; *The World Ham Net Directory* by Mike Witkowski, copyright 1989.

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